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21st Annual Session **AMERICAN CONGRESS OF PHYSICAL THERAPY**

SEPTEMBER 9, 10, 11, 12, 1942

HOTEL WILLIAM PENN

PITTSBURGH, PA.

Volume XXIII

AUGUST, 1942

No. 8

21st Annual Scientific and Clinical Session

AMERICAN CONGRESS of PHYSICAL THERAPY

September 9, 10, 11, 12, 1942

HOTEL WILLIAM PENN

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In Conjunction with the
21st ANNUAL SCIENTIFIC and CLINICAL SESSION

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September 9, 10, 11, 12, 1942

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THE PLACE OF PHYSICAL MEDICINE IN THE DEFENSE PROGRAM *

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The problem which confronts all physicians in the present emergency consists of: (1) the making of some of the unfit "fit to fight," for which Rowntree has coined the word "prehabilitation," (2) the actual treatment of injuries and illnesses sustained in the present defense effort and (3) the rehabilitation of those who have been sick or injured. The problem deals chiefly with the care of the young adult person. Physical measures play an extremely important part in the prehabilitation of those injured not only in industry, but also in military maneuvers and in actual warfare. Past and present experience gives evidence of the value of physical measures in such a program. Officials of the selective service system now are urging the prehabilitation of draftees. In a recent report the causes for rejection of draftees were listed as follows: dental defects, 20.9 per cent; defective eyes, 13.7 per cent; cardiovascular diseases, 10.6 per cent; musculoskeletal defects, 6.8 per cent; venereal diseases, 6.3 per cent; mental and nervous diseases, 6.3 per cent; hernia, 6.2 per cent; defects of ears, 4.6 per cent; defects of feet, 4.0 per cent; defects of lungs, including tuberculosis, 2.9 per cent, and miscellaneous, 17.7 per cent.

It will be seen that musculoskeletal defects and defects of the feet comprise 10.8 per cent of all the disabling conditions, and physical measures are especially important in the rehabilitation of such defects. Likewise, in the management of certain venereal diseases in cases in which the disease is resistant, fever therapy remains a valuable procedure.

If a comparison can be made between the disabilities that occur in present-day civilian life and those which are likely to be encountered in military life among the youthful enlisted personnel, the figures of Hilleboe should be of value. Recently he stated that, "From an analysis of the cases under twenty-one years of age in the central registry (of the State of Minnesota) it has been determined that the causes of the 8,300 disabling conditions are distributed in arbitrarily classified groups as follows: accidents, 11 per cent; anterior poliomyelitis, 20 per cent; arthritis, 2 per cent; cerebral palsies, 14 per cent; congenital deformities, 25 per cent; muscular dystrophy, 1 per cent; osteomyelitis, 4 per cent; rickets, 5 per cent; scoliosis of unspecified etiology, 1 per cent; tuberculosis of bones and joints, 3 per cent and a miscellaneous group, 14 per cent."

If these figures are analyzed, it is immediately apparent that the use of physical and occupational therapy, as developed during the World War of 1914-1918 and as elaborated on since that war, will be of great value in the rehabilitation of many patients who have these disabilities.

The rehabilitation of patients who have various types of orthopedic conditions is one of the most important phases of the work of a department of physical therapy. Goldthwait has said that, "An operation upon a bone or

* Read at the Course of Lectures, Demonstrations and Clinics on Problems Related to Medical and Surgical Emergencies Encountered in Civilian and Military Practice, Rochester, Minnesota, November 11, 1941.

joint may be technically most perfect, but unless the performance is executed with reference to later usefulness or unless measures having to do with the restoration of function are instituted as soon as possible after the healing of the wound, a result that might have been perfect may, from the point of view of function, be very poor.

"In the American army results of just this sort led to a very considerable number of men coming back to the rear, reporting not only unsatisfactory results from the point of view of the man, but equally unsatisfactory from the point of view of further usefulness of these men to the army. A similar condition had resulted in the first two years of the war in England where the great numbers of wounded men had finished their surgical treatment with such unsatisfactory functional results that it became necessary to institute measures for the correction of these conditions on a very large scale."

Goldthwait further stated that, "The recognition of the corps of reconstruction aides and the fact that these aides have been assigned not simply to the hospitals in the remote rear but have been gradually assigned to hospitals with the army in the front is an indication of the extreme to which the principle of the early application of measures having to do with the ultimate function has been applied."

Unquestionably, physical therapy was of great value in the restoration of function during World War I and in its present state of development it will be of still greater value. One may well conclude with Malkin that physical therapy, "particularly that aiming at re-education, has a most important part to play in the treatment of injuries. It should be arranged, however, so that there is no interference with continuity of treatment, and it should be carefully supervised. In many cases its usefulness would be increased by association with a rehabilitation workshop."

As Stevens has pointed out in regard to physical therapy, "by far the most valuable service which it renders is in the preservation and restoration of joint function."

With regard to the treatment of fractures, Philip Wilson stated that the chief principles of the treatment of fractures are: "First, restoration of anatomic form as soon as possible after injury; second, maintenance of alignment and fixation of the fracture during the period of healing; third, institution of measures to overcome the circulatory disturbance and to maintain and develop function, beginning at the earliest possible moment after injury and continuing until complete recovery is obtained."

He further stated: "The only measures at our command capable of accomplishing this purpose belong to the domain of physical therapy and they should be included just as regularly in the treatment of fractures and employed with the same skill as are reduction of the fracture and splinting to maintain alignment."

During the Spanish Civil War, Trueta's experience with Winnett Orr's method of reduction, débridement and prolonged application of windowless plaster casts resulted in only six deaths and ninety-one "poor results" in 1,073 cases. Patients who receive such treatment later will require prolonged physical treatment to restore function.

The use of physical therapy and occupational therapy plays perhaps the most important part in the rehabilitation of the patient disabled by arthritis, and today, as during the first World War, these types of treatment are of

great value in the rehabilitation of patients who have undergone amputation, or have sustained dislocations, or injuries of peripheral nerves or other traumatic lesions.

"Prehabilitation" must be done in civilian hospitals and in private practice. Actual treatment of those injured in industry also must be accomplished in civilian institutions. In addition, with an army of a million and a quarter men actively engaged in military maneuvers, and with a navy engaged in the active convoying of ships and in battle, a large number of traumatic lesions is being encountered in the new army and naval hospitals. Finally, it will be necessary to rehabilitate many of these injured persons. To accomplish the physical treatment of this large group of patients, a great increase in technical and medical personnel is required. In the field of physical medicine there are available at present about 100 civilian-trained physicians and about 1,200 civilian-trained technicians. In addition, there are needed at once about fifty trained physicians and about 350 technicians for military service, plus 700 technicians for civilian service. In case of a "shooting war," it is estimated that 300 physicians and 2,400 technicians will be needed. A year ago, I reported before the Medical Military Inactive Status Training Unit at Rochester, Minnesota, that steps were being taken to meet these demands. I am happy now to report that considerable progress has been made in the past year. Emergency training courses for both physicians and technicians have been established not only at this institution, but also at Northwestern University Medical School, at the Harvard Medical School, at the Cornell University Medical College, at the New York University College of Medicine, at the Washington University School of Medicine in St. Louis, at the White Memorial Hospital in Los Angeles, at the Walter Reed General Hospital in Washington and at the University of Minnesota Medical School in Minneapolis.

The army has designated eight medical centers at which physicians can be trained in physical therapy. Already four army officers and three naval officers have been trained at the Mayo Clinic in Rochester to man such training centers, and additional officers are to be sent to the clinic for such training. At this clinic eighty technicians are being trained each year to supply the need in army, naval and civilian hospitals. The Committee on Physical Therapy of the National Research Council has been extremely active in organizational work. Personnel has been classified, and an instruction manual has been selected. Also, a small guide to physical therapy has been prepared which will be printed by the American Medical Association and sent to all medical officers of the army and navy. In addition to progress in the training of personnel, progress in the provision of necessary equipment has been made. The committee has classified and recommended the necessary equipment for physical therapy departments of army general hospitals. It also has specified the correct equipment for army occupational therapy departments and has made recommendations concerning technical personnel for such departments. It has been necessary to set up an entirely new plan with the Civil Service Commission for the acceptance of apprentice physical therapy aides. This plan now is functioning smoothly. It has been necessary also to see that the Office of Production Management issued proper priority ratings for physical therapy equipment for use in civilian hospitals. I am happy to inform you that an A-10 rating has been given to such physical therapy equipment.

In well-conducted civilian hospitals, about a twelfth of all the patients require some form of physical treatment. In military hospitals, the percent-

age may be very much higher; for example, at the Walter Reed General Hospital in Washington, a fifth of all the patients are treated by the physical therapy department. It is probable that there is a tendency in military hospitals to send too many patients to the physical therapy service. In this connection, the comment of an outstanding naval medical officer is of interest. Recently, he wrote to me: "I have been interested in physical therapy for many years, as more or less of a hobby and was able to understand what I was up against with less effort than would occur with men not so trained. It is a pity that the military services are both allowing their physical therapy departments to become the 'catch-all' for patients that nobody else wants, and thus bringing medicine into disrepute. It is also unfortunate that too few men properly trained have gone into the field, and I think that we may expect a considerable number of headaches because of this picture. I am also certain that physical therapy will be revived and will be in all of the large Government hospitals, if we should finally get into a 'shooting war'."

There can be no doubt that this ranking naval officer is correct in his final conclusion. Trained medical and technical workers will be able to apply physical measures correctly, and it is now apparent that distinct progress is being made in providing such skilled persons. When properly organized, the departments of physical therapy will not become "catch-alls," and when educational manuals are distributed to the medical personnel, the indications for the employment of physical measures will become apparent.

The efficient use of physical measures in the present emergency will be directly proportional to the knowledge of the persons who employ such measures. The educational campaign of the Committee of Physical Therapy of the National Research Council is progressing apace, and there is now every reason to believe that satisfactory arrangements to meet the emergency will be made. However, we must not relax our efforts to provide adequate physical "prehabilitation," physical treatment and physical rehabilitation of our selectees and industrial workers, as well as of our soldiers and sailors.



PHYSICAL THERAPY IN ARTHRITIS

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The term chronic arthritis in this article will be used to include only rheumatoid arthritis and osteoarthritis. Treatment is entirely symptomatic because the causation is unknown and specific therapy is therefore not available. For the relief of pain and stiffness, for the maintenance of muscle tone and the prevention of muscle atrophy, for the preservation of joint motion and the avoidance of muscle contractures and for the rehabilitation of the arthritic cripple, physical therapy is a much neglected field which deserves further attention from specialist and general practitioner. Under suitable direction the simpler procedures are adapted to successful home use.

Rheumatoid arthritis is a systemic disease, the most severe manifestations of which are apparent in the joints. It affects women three times as commonly as it does men and comes on usually between the ages of 20 and 40 years; the subjects are often thin, pale and obviously ill. General debility is a common accompaniment. The disease involves multiple joints and has a special predilection for the joints of the hand. The joints are swollen, tender and stiffened. Contractures and deformities are common, and muscle atrophy may be extreme. The disease progresses slowly, with occasional interruptions, and may produce severe and permanent disability.

Osteoarthritis occurs in persons beyond middle life, does not affect the general health, affects the two sexes equally and tends to involve fewer and larger joints than does rheumatoid arthritis. It causes pain, creaking and swelling of the joints. The patients limp and complain, but they are seldom completely disabled, though the symptoms persist until death.

Treatment of these diseases requires good general medical care with attention to immediate comfort of the patient, general nutrition, control of weight, elimination of obvious foci of infection, physical, mental and emotional rest and care and protection of the affected joints. Physical therapy is particularly important for the last. It is certain that patients have recognized the value of physical measures in the care of the involved joints. Because the attending physician does not have the means available or is unable to arrange for their use in the home, the arthritic patient seeks the help of irregular practitioners, some of whom have utilized physical measures successfully and profitably.

The application of physical therapy is not difficult, and many procedures can be used by the general practitioner. Some of these procedures are simple and require a minimum of inexpensive equipment, making it possible and advisable for the physician to prescribe them for use in the home. Since various forms of arthritis are chronic and persist for months or years, few patients can afford the expense of continuous treatments in the hospital or the services of a visiting physical therapy technician. Home treatment has the added advantage of being available two or three times a day if indicated. Various procedures which are more complicated require the personal supervision of the physician or physical therapy technician and are therefore applicable only in the physician's office or the hospital's physical therapy department.

* In Foreign Service.

The principal forms of physical therapy used in the treatment of chronic arthritis are heat, massage and exercise. Using these basic measures alone, the arthritic patient may be adequately treated with physical agents.

Heat

Moderate heat dilates the capillaries, increases the circulation and accelerates tissue metabolism. The number of functioning capillaries in rheumatoid arthritis is markedly increased by local heat. Local heat secures mild analgesia in painful joints and makes the cold clammy skin of the patient with rheumatoid arthritis warm and red.

Local Heat

Several simple and inexpensive types of heating apparatus are effective. Infra-red lamps with incandescent tungsten filament bulbs are the best radiant heaters for general use. The bulb type of lamp emits a higher percentage of near infra-red rays than the heating element type of lamp, such as the ordinary bathroom heater. It has been found that the near infra-red rays penetrate to the corium and the subcutaneous layers of the skin, while the far infra-red rays do not. They are absorbed chiefly in the superficial layers. These heat lamps are marketed with bulbs from 250 to 1,500 watts, enclosed in reflectors to concentrate the heat, and are usually mounted on stands or clamps. The bulbs with larger wattage allow application of heat to a larger area at one time.

When a heat lamp is used in the treatment of joints, an exposure of thirty to forty-five minutes two or three times a day is better than too long an exposure at one time. The acutely involved joint requires less heat than the more chronically involved joint. The distance of the lamp from the joint depends on the condition of the joint, the type of lamp and its reflector. The ordinary lamp of 250 watts with a relatively small hood and a good reflecting surface is usually placed so that at no time should the radiation

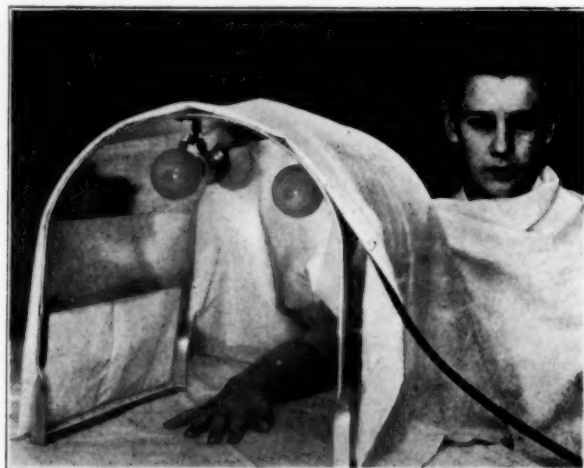


Fig. 1. — Ordinary baker.

feel uncomfortable. The patient who uses a lamp at home should be given specific instructions as to the type of lamp, the distance and the frequency of exposure. Should he complain of pain one or two hours after the treatment, the intensity was too strong or the time too long and the subsequent treatment should be reduced.

The "bakers" are a convenient means of applying local heat. They contain four to six bulbs of 60 watts and are mounted in a frame (fig. 1). They are light in weight and permit the heating of a large area at one time, an advantage in many cases. They can be made cheaply, are convenient to handle and are particularly satisfactory for use in the home.

Paraffin. — Paraffin treatment is excellent for the hands or the feet in both rheumatoid arthritis and osteoarthritis. Several pounds of ordinary paraffin is melted in a fairly deep double boiler and allowed to cool until a thin scum forms on the surface; it is then ready for use (fig. 2). Because of the high specific heat and the low conductivity of paraffin, a temperature of 125 to

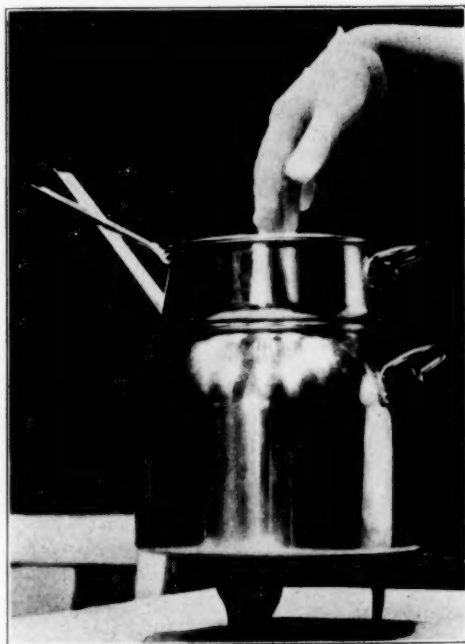


Fig. 2. — Paraffin bath.

135 F. is well tolerated by the human skin. The patient dips his hand or foot in the melted paraffin and withdraws it. A thin coating is formed over the part, and after the process is repeated eight to ten times, this coating has become a glove approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch thick. The part is then wrapped in a heavy towel which is left in place for twenty to thirty minutes. At the end of the treatment the paraffin is easily peeled off, and it may be used again. If a patient with arthritis cannot move his arm easily, the paraffin may be applied with a paint brush covered with several layers of gauze. Other parts, such as the knee, shoulder or back, may also be coated with a paint brush. After the use of paraffin, the pale, cold clammy hand of the patient with rheumatoid arthritis becomes warm and red. Pain is diminished and stiffness is reduced. Hyperemia may persist for one to two hours. Besides inducing a higher temperature, paraffin leaves the skin soft instead of macerated, as when water is used. Paraffin is one of the most satisfactory means in the home which can be used to apply heat to the various joints, and it is one of the least expensive.

Contrast Baths. — Contrast baths are easily used at home. Two containers are filled with water, one at a temperature of 100 to 110 F. and the other at

a temperature of 60 to 70 F. The patient immerses the extremity in the warm water and then in the cold water, and recent advances have shown that the immersion should be longer in the hot water than in the cold, four minutes for the hot and one minute for the cold.

Diathermy. — Diathermy has proved to be one of the most effective means of inducing heat in the joints and surrounding structures. The short wave current is more penetrating and convenient in securing active hyperemia than the older long wave type of diathermy produced by a spark gap. Short wave diathermy machines are costly and require supervision of the physician or physical therapy technician; treatments are best given in the physician's office or in the physical therapy department of a hospital. For best results, short wave diathermy treatments are given daily or two or three times a week and are supplemented with simpler forms of heat treatments at home. The technic is simple, but certain precautions are necessary. Because the energy is potent, the intensity of the heat is kept low and the duration of the treatment is short; this is particularly important in the initial sessions. It is advisable during the first few treatments to ask the patient repeatedly if the heat is comfortable. Exacerbations, with an increase in the swelling, pain and stiffness in the joints, may follow too strenuous a treatment. The first treatment is given for ten to fifteen minutes, and subsequent treatments are increased to twenty to thirty minutes after the patient's tolerance has been ascertained.

General Heat

Heat in its various forms is applied to the entire body in an effort to stimulate general metabolism and to increase circulation throughout the whole body. No attempt is made to elevate the body temperature.

Baths. — The ordinary bathtub is the simplest and most convenient means of securing general heating, general relaxation and relief of muscle spasm and pain. The temperature of the water is 95 to 100 F. at the outset and is gradually increased to 104 to 105 F. The patient is kept in the tub from twenty to thirty minutes but never long enough to cause fatigue. If the patient is completely immersed to the neck the general body temperature will be raised by this bath. Therefore for general heat application the arms, shoulders or legs should be out of the water part of the period. Not more than three such warm baths should be given per week. After the bath the patient is kept warm and allowed to rest for at least one hour. The addition of sulfur, magnesium sulfate and other salts and the use of ingredients from renowned spas have been recommended, but there is no proof of their effectiveness.

Bakers, or Cradles. — Bakers for general heating are large enough to cover the entire body except the head and are similar to the small bakers which are used for local heating (fig. 3). The baker is covered with a blanket or two in order to prevent loss of heat. The temperature maintained inside the baker is usually about 120 F. and is regulated by turning the lamps on or off. An exposure of twenty to thirty minutes is usually sufficient to cause mild sweating and considerable subjective relief.

Cabinets. — Cabinet treatments are given to the more or less robust arthritic patient and their use is primarily a hospital or institutional procedure. The ordinary cabinet is made so that the patient sits upright with his head outside but this is not as useful as the reclining type of cabinet. The baker shown in figure 3 may be used. Heat is supplied by incandescent lamps, which can be regulated to control the cabinet temperature. After the treatment, which usually is continued for about fifteen minutes, the patient is given a warm

shower followed by a full body massage and is allowed to rest for one hour or more. This is an excellent means of securing a general tonic effect for the entire body and is particularly useful in treatment of the overweight patient with osteoarthritis.

Massage

Massage is one of the most useful agents in the care of the arthritic patient. Few, if any, advanced cases of arthritis of either the atrophic or the hypertrophic type can be expected to recover without recourse to the principles of physical therapy, intelligently ordered rest and massage in particular. Regardless of the type of arthritis, the circulation is impaired, induration or edema is likely to form and the muscles, owing to disuse, tend to lose their tone and become atrophied. Massage can influence these difficulties to a great extent. It aids the absorption of fluid in and about the joints and improves the circulation in the muscles and other structures, and the joints can

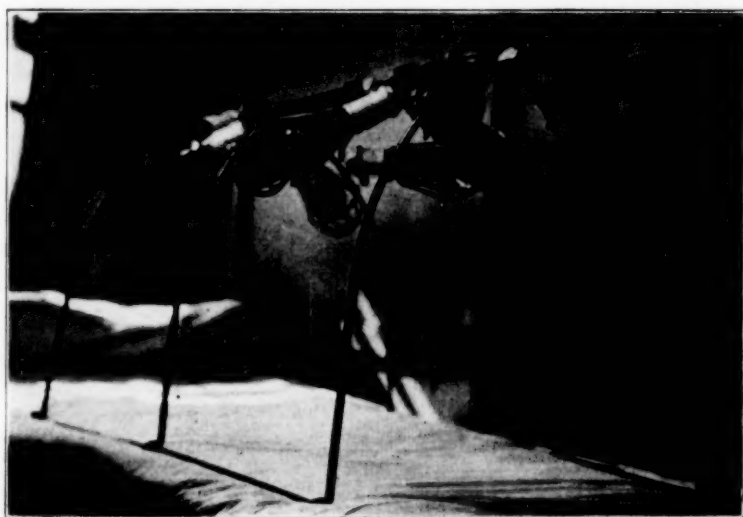


Fig. 3. — Body baker.

then be moved more easily and less painfully. It secures a general relaxation of the body and instills in the patient a sense of well being, which results are not as easily obtained with other remedies. The nature of the disease favors the formation of fibrosis in and about the tendons, muscles and joints, and massage is an effective measure in aiding its removal.

Massage is always preceded by some form of heat. It is the combination of heat, massage and the other physical methods that is indispensable in the treatment of chronic arthritis. Each measure though important and capable of bringing about specific effects in itself is not to be used alone. The technic in applying massage follows certain general principles. The methods are not difficult but require some training and experience. In the *Handbook of Physical Therapy* there is found an excellent outline which embraces the essential varieties of massage for an arthritic patient. The following instructions are given for home treatment:

Heat should be applied before the massage.

Be sure the part is relaxed and comfortable and there is no tight clothing to bind.

Massage should never hurt.

Never massage bones or joints if they are at all painful or swollen.

To apply massage, the hand of the operator should be relaxed so that it fits the shape of the part to be treated. The hand should move smoothly over the surface. If the skin is dry, a small amount of cold cream, olive oil or cocoa butter should be used. If moist and sticky, talcum powder may be preferred. Pressure should be firm, but gentle. Never cause pain.

Heaviest pressure should be in the upward direction toward the heart, very light pressure downward. The hand should be kept in contact with the skin at all times.

The movements used are:

1. *Stroking*, which is a long smooth movement with even pressure upward, or light pressure downward; the entire hand is used on large muscles, the ball of the thumb on small parts, as the fingers.

2. *Kneading*, the hand grasps the muscle and gently squeezes and pushes in an upward direction, then relaxes and grasps again. Care should be taken not to pinch. Follow with a light stroke downward.

The treatment should begin with stroking, then a period of kneading and stroking alternately, finishing with stroking.

Order of treatment:

Arm movements reach from elbow to shoulder, then wrist to elbow, then finger tips to wrist. Finish with stroking from finger tips to shoulder.

Leg movements follow the same order as arm.

Shoulder movements extend from back of neck to shoulder tip, chest to shoulder tip, then elbow to shoulder.

Back movements:

1. With hand close to each side of spine, start from lower part and press upward towards neck.

2. Starting at lower part of spine, press outward to the sides, working upwards towards neck.

Length of treatment is about 10 minutes to arm or shoulder and 10-15 minutes to leg or back.

These two methods of massage, namely stroking and kneading, are the types most frequently employed for arthritis. Light stroking is used at the onset of the disease. The lighter stroke is a vasodilator and opens the capillary bed, causes relaxation and diminishes pain. Joints that are acutely inflamed, are avoided. A skilful technician who understands the pathologic process in the joints may with a light stroking massage bring about a certain analgesic effect, but to rub over such joints indiscriminately not only causes more pain but adds to the trauma already present. Later in cases of rheumatoid arthritis of long standing, when the muscle tone is decreased and general circulation is poor, a more vigorous massage is indicated; the compression movements of kneading and friction can be employed to advantage. These movements are used on practically all patients with osteoarthritis.

Massage is best administered by a trained technician. Since this is not always expedient, a member of the family can be taught to massage the patient under the direction of the physician.

Exercise

Exercise is an effective measure but must be used with care. It requires patience, tact and an understanding of the disease process which is present in arthritis. The use of exercise differs for the patient with rheumatoid arthritis and the patient with osteoarthritis.

Rheumatoid Arthritis: Exercise and Care. — In this type, exercise is essential to prevent deformity and ankylosis of the joints and muscle atrophy. For an acutely swollen, painful joint both active and passive exercises are properly delayed, but to wait too long in starting them will favor the development of permanent disability. It is difficult to decide when to begin. However, it is well to have the patient attempt active exercises, that he can do himself, as soon as possible. If they cause undue pain, they must be stopped. Many patients will wiggle a joint twenty or thirty times, but this not only fails to maintain, or improve the range of motion but irritates the joint.

The following set of exercises for individual joints may be given to all patients with rheumatoid arthritis. They are demonstrated to the patient, and the importance of securing as near a normal range of motion as possible is stressed. The instructions are mimeographed and given to the patient to refer to at home. The purpose of this set is to exercise every joint through its proper movements.

In exercising a joint, attempt complete range of motion slowly. Exercise once every day.

Head: Turn right, left, forward, backward. Bend to right, then left.

Shoulder: Swing arm forward over head, sideward over head, backward as far as possible. Place hand from neck to lower back with elbows bent.

Elbow: Bend arm, straighten out arm. Touch hand to shoulder, then return to side.

Wrist: Bend, straighten out. Palms up, move wrist sideward. Keeping elbows still, palms up, palms down.

Fingers: Bend first at knuckles, then next joints and finally end joints. Touch palm. Straighten out in reverse order. Separate fingers, stretch and close tightly. Touch each finger separately with thumb.

Hip: Raise and lower leg with knee straight. Raise and lower leg with knee bent. Move leg to side with knee straight, bring leg in. Move leg across other leg with knee straight.

Knee: Contract muscles without bending knee. Bend and straighten out leg.

Ankle: Raise toes upward and bend downward. Foot circling.

Toes: Bend, straighten out.

The following instructions, for routine exercises for arthritis, are also given. The exercises to be performed are selected by the physician, and emphasis is placed on thoroughness. The exercises must be done slowly and carefully and stopped as soon as they cause fatigue. They stress breathing, posture and general bodily mechanics.

Do the exercises marked twice a day—at the beginning do each exercise five times, later increase to ten times. Rest between each exercise; never fatigue. Rest after exercises are finished. Exercise slowly and carefully.

Lying: Firm flat surface—no pillow under head.

1. Hands behind neck, elbows touching bed. Small pillow or rolled up towel between shoulders. Breathe in deeply, breathe out by pulling in abdomen, keep chest up.

2. Hands behind neck, elbows touching bed. Small pillow or rolled up towel between shoulders. Breathe in and only partially breathe out, then breathe in again and only partially exhale. Repeat again, then exhale completely.

3. Hands grab ribs at costal angle. Breathe in deeply, pulling ribs apart. Hold ribs out and breathe out by pulling in abdomen. Breathe in again by pulling ribs farther out. Repeat without permitting ribs to come back to normal position.

4. Hands behind neck. Elbows touching bed, knees bent. Push the back to the bed, drawing the abdomen in, and contract the buttocks.

5. Hands behind neck, elbows on bed, legs straight, back flat on bed. Bend one knee over chest then straighten out the leg and lower straight leg to bed slowly. Repeat with other leg.

6. Arms over head, hands grasp bed—keep back flat. Pull one arm so as to feel ribs moving on this side, then pull with other arm, then pull with both arms at the same time.

7. Hands at the side—back flat on bed. Raise one shoulder and feel ribs stretch, hold the position, then contract abdominal muscles on this side. Alternate to the other shoulder.

8. Hands folded across chest, knees bent. Raise head and shoulders from the bed, return slowly.

9. Hands up over head, knees bent. Raise head and shoulders from the bed, return slowly.

10. Face down, hands behind neck, pillow under abdomen—push elbows backward.

Sitting: Head up, chin in, back flat against straight chair, abdomen in, do not slouch, sit on hips not on spine, feet crossed.

11. Hands behind neck, elbows out. Same as exercise no. 1.

12. Same as exercise no. 2.

13. Same as exercise no. 4.

14. Hands on hips—elbows back. Bend trunk forward without arching back, backward, to each side. Twist trunk to each side.

15. Hands on head. Raise one shoulder, stretching ribs on that side, repeat for other side, then together.

Standing: Head up, chin in, hips back, abdomen in, back flat, raise chest, feet parallel 4 to 5 inches apart.

16. Hands on hips. Same as exercise no. 1.

17. Same as exercise no. 2.

18. Same as exercise no. 3.

19. Hands at sides, heels 4 inches from the wall, head, shoulders and hips touching wall. Push back to wall by contracting abdominal muscles and buttocks.

20. One hand at back of neck, elbow back, other hand at side. Bend body to the side of hand at the side, straighten up and repeat to the other side, alternate position of hands. Do not move hips.

If a patient can be taught and inspired to carry out these instructions patiently and consistently each day, he is reasonably assured of avoiding disabling contractures.

Posture in this form of arthritis is notoriously poor and with the aid of these exercises may be corrected. Defects in bodily posture affect patients with arthritis in five ways. (1) Poor posture is a mechanically inefficient carriage and therefore requires an undue amount of energy in standing and sitting. In this way it adds one more burden to the already overburdened constitutional inadequacy of these patients. (2) It produces ptosis of the gastro-intestinal tract and decreases the vital capacity of the lungs. This embarrasses the normal function of these organs. (3) It predisposes to lower back pains. (4) It causes undue trauma at certain joints, predisposing these to the localization of arthritis. (5) It has a depressing psychologic effect.

The two sets of instructions are of vital importance. The first set is required of all patients. Exercises from the second set are selected for the individual patient as indicated. These sets are by no means complete but serve as a guide. They should be varied from time to time to prevent monotony and loss of interest.

The use of the so-called muscle-setting exercises is beneficial when movement of the joint is impossible owing to pain or immobilization; for example, the quadriceps group of muscles can be contracted without moving the knee joint and the deltoid muscle without raising the arm. This is a normal physiologic contraction and aids in maintaining the tone of the muscle. These exercises are to be done two or three times a day and repeated ten times.

Exercises can be given under water. The buoyancy of the water overcomes the pull of gravity and movements are possible in all directions. The water should be warm, about 95 to 100 F. This causes complete relaxation, relieves spasm of the muscles and decreases pain, thus favoring a greater range of motion for the joints. The Council on Physical Therapy of the American Medical Association furnishes specifications for making the Hubbard tank.

Passive Exercise. — Passive exercises, which are performed without the aid of the patient, are at times necessary. Adhesions form about the joints which the patient cannot overcome by active motion. The movement of a stiff joint requires much patience and fine judgment. One of the commonest errors in general is that of inducing twisting movements to the finger or other joints, together with passive flexion and extension of nearly all involved joints. A subsiding arthritis may easily be perpetuated or made worse by activities of this sort. From the standpoint of possible trauma to the joint structures, many orthopedists believe that passive motion to joints is accompanied more often by detriment than by benefit. There are some exceptions to this, but in any event great conservatism must be adopted toward it.

Passive exercise is best supervised by a physician or physical therapy technician, but this is not always practical. At times the technic must be taught

to an intelligent member of the family. Passive exercise is used to put the affected joints through a full range of motion once a day. A slight amount of pain is inevitable, and if this persists longer than one to two hours after the exercise, the treatment was too severe and subsequently must be gentler.

Rest. — The importance of physical, mental and emotional rest and calm for the debilitated arthritic patient has not been sufficiently emphasized. The patient with chronic arthritis has a generalized disease, and conservation of strength by rest in bed is sometimes indicated. This often has a beneficial effect on inflamed joints. The fear of impending crippling and joint stiffness from lack of activity must be allayed by the physician. Exercise in bed, with the joints being put through the range of motion tolerable for them several times a day, is helpful. Complete fixation for short periods may be necessary for severely inflamed joints, but this must not be continued after inflammation has subsided. Deformities must be prevented by orthopedic care.

Despite the most competent care and the cooperation of the patient, stiffness and ankylosis may occasionally develop. The use of the following positions, particularly at night, will assure best function if stiffness or ankylosis results.

Back: Firm straight bed; boards may be inserted between the mattress and the springs. A small pillow under the head or no pillow at all is preferable.

Shoulder: Arm held in abduction, approximately 70 degrees, and full external rotation.

Head: Straight forward, maintained by posterior plaster shell or by sand bags.

Elbow: At about 90 degrees flexion, rotation of arm midway between supination and pronation.

Wrist: At about 30 degrees dorsiflexion.

Hand: Secure palmar arching, prevent ulnar deviation.

Fingers: Alternate nights with flexion of all joints and complete extension of all joints. Thumb is left free.

Hip: Complete extension with about 10 degrees abduction.

Knee: Complete extension, no rotation.

Ankle: Foot at right angle to leg and slight inversion.

Toes: Complete extension.

Osteoarthritis: Exercise and Care. — The joints rarely become deformed or ankylosed, so that exercises to prevent such disability are not necessary. The patient is usually overweight and demonstrates poor body mechanics. He frequently shows marked lumbar lordosis and a pendulous abdomen. The improper alignment of the body causes undue stress and strain for the hip, knee and ankle joints. Correcting the posture of this type of patient helps reduce his symptoms.

Special exercises for the individual joints are seldom necessary. It is generally better to rest the affected joint than to put it through a routine of exercises. At times complete rest in bed with no motion of the joint will secure subjective relief. The patient is fearful of a stiff joint and believes that no motion over a period of time will result in ankylosis. He usually states that in the morning or after sitting it is difficult to move, but after minutes of limbering up, he is able to use his joints without too much difficulty. However, overuse of the joints results in more irritation and more stiffness. At times a mechanical device is employed to limit the motion of the joint or completely immobilize it. Such devices are worn for a short time; then active motion is permitted.

Light Therapy

Sunlight and artificial ultraviolet irradiation have been used extensively in treating rheumatoid arthritis. There is no scientific proof that such treatment has any specific effect, but the patient seems to feel better, his appetite improves and he sleeps better. Care must be observed not to overdo the ex-

posure, particularly at first, before the patient is used to the irradiation. For artificial irradiation an air-cooled quartz mercury arc lamp or a carbon arc lamp may be used.

Ion Transfer

Ion transfer is the introduction into the skin of vasodilating drugs by the use of a galvanic current. Histamine and acetylbetamethylcholine chloride, both of which stimulate the parasympathetic nervous system and produce peripheral vasodilation, are used in the treatment of rheumatoid arthritis. They are recommended for patients with cold, damp and cyanosed extremities, for patients with paresthesias and sensitivity to cold and for patients with evidence of neuritis due to root irritation from spinal arthritis, for example sciatica.

The treatments require relatively expensive apparatus and costly drugs and are confined to use in the physician's office or a hospital's physical therapy department. This therapy compares favorably as to results with the other methods and may be employed when the simpler measures are ineffective.

Fever Therapy

During the past ten years various physical means of elevating the bodily temperature have been developed, for example air-conditioned cabinets, and short wave diathermy. These are relatively safe for producing the desired elevation of temperature, which may be maintained for a prescribed period.

Artificial fever treatments should be given only in a hospital and by adequately trained personnel of physicians and nurses.

Conclusion

In the preceding pages consideration has been given to the use of physical agents in the treatment of chronic arthritis. The simpler methods may be employed by the general practitioner either in his office or in the home. The more complicated measures, such as fever therapy and ion transfer should be given only in the hospital. Physical methods when used intelligently and consistently and in conjunction with the other accepted forms of therapy will not only make the arthritic patient's existence less painful and distressing but be a means of securing a more prompt and satisfactory return to normal.



INJURIES TO JOINTS

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Joints may be sprained or dislocated, or, as in the case of the knee, the internal architecture may be deranged. The pathologic changes are similar in the three types of injury, differing only in degree and extent.

Statistical studies of "athletic injuries"¹ indicate that sprains are the most frequent. The joints most frequently involved are the ankle, knee, shoulder, wrist and elbow.

The ligaments most frequently involved about the ankle are the anterior talofibular, the calcaneofibular, the posterior talofibular and the anterior lateral ligaments. Those about the knee are the tibial collateral (O. T. Internal Lateral), the fibular collateral (O. T. External Lateral) and the tibial collateral associated with the medial meniscus. In the shoulder the acromioclavicular and the coracoclavicular ligament are the most commonly involved.

Pathology

Miltner and his co-workers² have studied the pathologic changes occurring in the knee joint of rabbits after experimentally produced sprains. Two types of sprains were produced without dislocating or fracturing the bones involved. The mild sprains examined grossly and microscopically showed (1) an increase in amount and viscosity of the synovial fluid, (2) edema of the synovial membrane with small foci of hemorrhage, (3) edema of the capsule near its attachment to the bone with fibroblastic proliferation and infiltration with lymphoid cells and (4) evidence of hemorrhage in the subcutaneous and loose connective tissue. In severe sprains, in addition to these changes there were (1) fibrillar degeneration of the surface layers of the articular cartilage and areas of degeneration in the free portion of the semilunar cartilage and (2) definite evidence of tearing injury at the point of insertion of ligaments to bone, with an increase in fibroblasts, vascular dilatation and infiltration with round cells at this point.

In mild sprains the microscopic evidence of damage had disappeared after the sixth week. In severe sprains the process of repair was still evident eight to ten weeks after the injury.

Symptoms and Signs

The symptoms and signs vary with the degree of damage. Pain is an initial complaint, is constant and is accentuated on motion of the joint, especially when tension is placed on damaged ligaments. The pain results in muscle spasm and loss of function. Swelling is an early sign and may increase to tremendous proportions in a brief space of time. This is especially true in injuries about the ankle joint. Tenderness is elicited by palpation, chiefly at the joint margin and at the point of origin or insertion of ligaments to bone on the affected side. This point tenderness may be masked by swelling, and accurate early diagnosis of the ligaments involved may be impossible for this reason. There is effusion of synovial fluid into the joint space, and this also may be difficult to detect because of soft tissue swelling, except in the case of the knee joint. Definite evidence of the extravasation of blood into the loose periarticular tissue is discoloration of the skin and subcutaneous tissue, which appears from twenty-four to forty-eight hours after the injury. The blood will gravitate considerable dis-

tances to the most dependent part of the extremity, and this fact must not be disregarded when therapy is being carried out.

Therapy

The principles of therapy are the same as for other soft tissue injuries and include, first, prevention of extension of the pathologic process initiated by the original trauma and, second, return of the traumatized tissue to its normal structure and function as soon as possible.

Early treatment of sprains is imperative and should begin as soon after the injury as possible. A compression bandage of the "ace" type on the outside of several layers of cotton wadding gives firm even pressure over the joint and allays the extravasation of blood, lymph and joint fluid into the surrounding tissue. This type of bandage also aids in immobilizing the joint. Rest should be provided as soon as possible, with elevation of the part, and the procedures should be accompanied by use of cold or ice compresses, which may be applied over the compression bandage. These procedures should be continued until extravasation of fluid into the subcutaneous tissue ceases. The objective is usually obtained within twenty-four hours.

After or during the treatment described, the extent of damage to the joint should be estimated by careful physical and roentgenologic examinations. The information obtained through these examinations should determine the therapeutic procedures to be used in the future, which generally include rest (immobilization), heat, massage and graduated exercise.

The amount of immobilization necessary and the period over which it should extend will depend on the estimated damage. A mild sprain accompanied by little pain and swelling needs no greater support than an adhesive tape strapping applied in such a manner and with the joint in such a position that tension is removed from the injured ligament. In injuries of this degree weight bearing and exercise should be permitted from the start, and generally no other form of treatment is necessary.

In the type of sprain which is accompanied by much swelling, pain and loss of function but in which it has been determined that the signs and symptoms are not due to extensive damage to ligaments, immobilization in a plaster cast or splint is not necessary. Rest in bed and elevation of the part is essential during the first twenty-four to seventy-two hours in the treatment of all sprains accompanied by these symptoms. After the first twenty-four hours it is generally safe to apply heat in the form of hot compresses. Massage may be added to the program if it is executed in the manner described for the treatment of muscle injuries. Graduated exercises should be instituted early and in such a manner that tension is not thrown on the injured ligament and the joint is not working against a load or carrying weight.

Ankle. — Sprains of the ankle after the first twenty-four to seventy-two hours can generally be treated as ambulatory. Before the patient is allowed up the ankle should be taped with adhesive. The leg is shaved and compound tincture of benzoin applied, after which, with the ankle held in the position previously decided on as best to relieve tension on the damaged ligament or ligaments, a basket weave adhesive bandage is applied. There are numerous modifications of this bandage, but all have as their objective the prevention of inversion or eversion and the limitation of plantar flexion. The tape may be removed daily for treatment without damage to the skin.

Weight bearing is prevented by the use of crutches. The patient should be instructed how to use crutches to carry out the normal mechanism of walking without weight bearing. This will lead to an earlier return of function in the joint and adjacent musculature. The muscles of the leg will be carried through

their normal arc of motion, abnormal tension will not be applied to them and stiffness and soreness will not develop in these muscles. Weight bearing should be increased as pain permits. A cane should not be used, as it leads to an abnormal gait and soreness of muscles.

Heat may be applied once daily for a period of thirty to forty minutes. The whirlpool bath is preferred, as it will include the entire limb and will allow early painless motion, which should be encouraged while the extremity is in the bath.

The heat should be followed by a period of elevation, during which the leg is kept warm by the aid of blankets. After the limb has been elevated a sufficient period, massage is given with it in this position and in the manner described for the treatment of muscle injuries.

The limb should be elevated after a period of walking and whenever the patient is at rest.

Treatment should continue until disappearance of the swelling and pain, which will require from four to six weeks. Adhesive tape support should be continued for eight weeks or longer if necessary and should be reapplied for a period of several months whenever severe strain is expected.

The treatment of an ankle immobilized in a plaster cast or splint differs little from that described except that the procedures cannot be started until the plaster can be completely removed or the splints removed temporarily for treatment. They can usually be carried out after a few days or a week. After a cast is permanently removed the ankle should be protected by adhesive taping and weight bearing should be instituted gradually with the aid of crutches.

A sprained ankle is not a benign injury. Some degree of swelling is usually permanent and pain may persist for a long time, especially when the patient is walking on an uneven surface. Ankle joints once sprained are frequently re-injured.

Knee. — Dickson³ said that in the treatment of any injury to the knee which produces effusion and definite symptoms of derangement the knee should immediately be immobilized in extension by a plaster cast and should remain immobilized until the acute symptoms subside. The cast is removed in a week or ten days for more complete examination and determination of the specific treatment indicated.

There are injuries to the knee which occur in athletic activities that are not followed by effusion into the joint but do present some tenderness to pressure over the attachment of one or the other of the two collateral ligaments to the bone. These minor injuries usually respond well to some type of heat applied daily, massage above and below the joint and support by an "ace" type bandage.

Dickson³ also stated that treatment of an initial injury to the semilunar cartilage and of any attack in the acute stage should be conservative. He also said that the keynote of conservative treatment of injuries to the cartilage is reduction of the displacement or of the fragment if the cartilage is fractured. Reduction is followed by the application of a cast extending from the upper part of the thigh to just above the ankle. The patient is allowed to walk with the aid of crutches.

During the time the cast remains in place the patient should be taught to contract the quadriceps femoris muscle statically. This exercise should be carried out frequently during the day. It will not produce motion in the joint but will aid in maintaining tone in the muscle, which, in spite of everything, will atrophy rapidly.

At the end of three weeks the cast may be bivalved and heat, massage and graduated exercise instituted. Any of the sources of heat previously mentioned may be used, but the whirlpool bath seems to be most useful, as it allows and

encourages painless, non-weight-bearing motion. The heat is followed by exercise, which is instituted first by eliminating gravity. Such exercise may be carried out with the patient lying on his side with the knee on a smooth, powdered, rectangular board. From this type of exercise the patient progresses to flexion and extension against gravity and finally against a load.

The cast is removed after the fourth week, and walking with the aid of crutches with the knee supported by a firm bandage is begun. Heat, massage and exercise should be continued until weight bearing without the aid of crutches and performance of a normal gait is possible. The musculature about the knee should continue to be strengthened by long walks on a smooth surface, or, in athletes, by running on the track.

Injuries to the lateral ligaments of the knee are treated by immobilization in a cast for four to five weeks, after which heat, exercise and massage are instituted as for cartilage injuries.

Cruciate ligaments require longer immobilization, and Dickson recommended absolute immobilization of the knee in complete extension for two or three months. After removal of the cast, physical therapy as outlined for the injuries previously discussed should be instituted.

Physical therapy is instituted after an operative procedure on the knee joint as soon as the cast is removed or bivalved; when no cast is applied it may be instituted at the end of a week.

Acromioclavicular Joint. — Injuries to the acromioclavicular joint may be limited to the superior and inferior acromioclavicular ligaments or may include the coracoclavicular ligaments and vary from a mild sprain to complete dislocation.

Mild sprains accompanied by pain on motion of the shoulder and tenderness over the joint but without clinical or roentgen ray evidence of dislocation usually respond well to adhesive tape support extending over the joint and anchored to the anterior and the posterior wall of the chest. The arm is carried in a sling for a week, after which activity is gradually resumed. No other form of therapy except heat applied over the point of tenderness once a day or oftener is necessary. A piece of elastic webbing 3 inches wide and several inches long incorporated into the adhesive support with the aid of safety pins and placed directly over the clavicle gives a more uniform pressure to this type of bandage, especially when the arm is elevated. The bandage should be changed every three or four days and worn over a period of four weeks. If the patient is engaged in athletic activities the bandage should be reapplied during such activity for a period of several months.

Severe sprains and dislocations need more adequate support, and most of them get it through some modification of the brachioclavicular sling principle described by Sir Robert Jones. Howard⁴ described a modification of this sling which has proved satisfactory in his hands in the complete as well as in the incomplete subluxations. He makes use of a right angle metal splint at the elbow to secure a firm, immobile point of attachment for his brachioclavicular sling. His sling is held in position over the clavicle by means of a band which runs diagonally across the chest wall anteriorly and posteriorly to the uninjured side and joins at the lower level of the rib cage laterally. This band is kept from slipping up by a transverse band which encircles the body. He prevents motion of the arm for the first two weeks, after which abduction, forward flexion and external rotation are carried out without pain or recurrence of the dislocation. This early motion prevents stiffness and contraction of the shoulder. The splint is used for four or five weeks and is followed by a muslin sling until motions of the elbow and shoulder, encouraged by exercise, are free and comfortable.

Dislocations of the scapulohumeral joint are satisfactorily immobilized by a muslin sling about the shoulder and a muslin bandage about the waist to anchor the arm to the side. This support is readily removable to allow the early application of some type of heat and massage. Active motion may be started by the end of the first week and should be carefully supervised by the physician. Abduction may be initiated with the patient in the supine position, elbow flexed to a right angle and held by the operator, the motion taking place on a powdered board to reduce friction. Forward flexion may be obtained by use of the powdered board with the patient lying on his side. As muscle tone improves and pain diminishes the exercise of abduction, forward flexion and rotation may be performed with the patient in the stooping position and finally in the upright position, either with the aid of a strap hung over a door and grasped in the hand so that the good arm is used as an aid in forward flexion and abduction of the injured arm or with the disabled arm crawling up the wall with the aid of the fingers. The patient faces the wall in carrying out forward flexion and turns with his side to the wall for abduction.

Wrist. — Before sprains about the wrist are treated the possibility of navicular fracture must be definitely ruled out. Navicular fractures require immediate and prolonged immobilization. Sprains may require immobilization, but it need not be absolute nor prolonged. A sprain may be immobilized during the acute stage with a molded volar plaster splint. This splint may be removed daily for heat and massage. After the acute stage is past the splint may be removed and the wrist protected by an adhesive strapping applied over a gauze bandage. This bandage should encircle the wrist and include the palm and dorsal surface of the hand, leaving the thumb and fingers free.

Sprains and dislocations of the fingers and thumb occur and are frequently accompanied by chip fractures. The simple sprains generally respond well to rest and protection provided by tongue blade splints or by taping of the injured finger to its neighbor. The thumb may be immobilized by being encased in an adhesive plaster bandage. This may be removed daily for soaking in a whirlpool bath. Sprains about the metacarpophalangeal joint of the thumb leave that joint weak and painful for a considerable period, especially when a grasping motion is performed.

Elbow. — Thorndike¹ stated that in the case of injuries about the elbow it is well to give a guarded prognosis even though the injury is of a minor nature. Myositis ossificans is a likely complication about this joint and is always incapacitating.

Mild sprains may be treated by the early application of cold compresses to prevent effusion, followed by a compression bandage applied with the elbow in 90 degree flexion and supported by a sling. Later treatment consists in the application of heat by means of a whirlpool bath, which at the same time allows early painless motion. Motion is increased as pain disappears. Massage about the elbow joint is not recommended. Jones⁵ said that this procedure along with passive exercise is a frequent cause of adhesions accompanied by limitation of motion. The joint is protected when activity is resumed by a figure-of-8 bandage to prevent hyperextension.

Dislocations. — Dislocations at the elbow joint are generally posterior. After reduction, cold applications may be applied to prevent swelling, followed by a compression bandage. There is a difference of opinion as to the proper position in which to maintain the joint after reduction. Authorities vary from those who advocate acute flexion with the wrist in supination to those who favor right angle flexion and a neutral pronation-supination position. "Muscle setting" exercise of the biceps and triceps muscles and the muscles of the forearm may be instituted early, while the arm is still in the sling. In this type of exercise the

muscles contract and relax but no motion takes place in the joint. As soon as the sling can be removed temporarily the arm may be placed in the whirlpool bath and active motion encouraged to the point of pain. As soon as the arm is out of the sling, exercises should be continued at home. Massage and passive motion are avoided. If during the course of treatment the range of motion decreases and swelling increases, activity should be reduced and the beginning of myositis ossificans suspected.

Tennis Elbow. — Tennis elbow has as many methods of treatment as there are suspected causes of the clinical syndrome, and Cyriax⁶ has listed some twenty-eight of these. Two successful therapeutic procedures fall in the realm of physical therapy — namely, mobilization and immobilization.

Mobilization. — English practitioners in particular advise mobilization and agree that this is the procedure of choice when the condition is chronic and neglected. The procedure, with various modifications, consists of forcing full extension at the elbow, thereby exerting a pull on the muscles attached to the lateral epicondyle of the humerus.

Mills,⁷ with the patient anesthetized, puts the forearm, hand and fingers in full flexion and the forearm in pronation, and with the thumb of the other hand presses firmly just below the external condyle while forcibly extending the forearm. The procedure is rarely repeated.

Cyriax,⁶ with the patient seated, elbow flexed to a right angle and forearm supinated, applies deep friction massage to the anterior part of the lateral condyle for five to ten minutes. The elbow is then fully extended as far as possible, and the forearm is supinated. One hand of the operator is placed on the inner side of the elbow and the other on the outer side of the wrist. The forearm is now adducted on the arm with a sharp jerk toward a position of cubitus varus.

This procedure is carried out without an anesthetic and is repeated three times a week. The elbow may be sore for one or two hours after treatment. The average number of treatments required in this series was four, with a range of one to nine for a total of 20 patients. There was one failure.

Cyriax maintained that the mobilization converts a partial tear of the tendinous origin of the extensor carpi radialis brevis muscle into a complete tear, the epicondylar periosteum, now separated from the extensor tendon, is spared direct pull and heals with permanent slight lengthening of the tendon. Mobilization is equally applicable to acute and chronic lesions.

Immobilization. — Hansson and Horwich⁸ stated the belief that the lesion is a periosteal fracture with myositis of the extensor muscles. They place the wrist in a cock-up splint, preventing extreme supination and pronation and relaxing the extensor muscles. The average period during which the splint was worn in their series was thirty-two days, with a range of eight to sixty-seven days. The method was successful in 12 of 16 cases.

Cyriax was able to justify the success of immobilization treatment with his theory as to the etiology of the complaint. He said that during the period of splinting the tear between the tendinous origin of the extensor carpi radialis brevis muscle and the periosteum heals. His objection to the method is that the healing occurs without lengthening and there may be recurrences. He also stated that the method is more suitable for recent than for chronic lesions.

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PHYSICAL THERAPY IN CEREBRAL PALSY

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Cerebral palsy is a condition in which disturbance of muscular coordination occurs. Mental defects may or may not accompany it. The condition may be congenital; caused by cerebral damage occurring before, during or immediately after delivery, or acquired after encephalitis, accident or the like. Formerly, hemorrhage during labor or immediately after birth was accepted as the only cause of cerebral palsy,¹ but more recently other causes have been recognized. Degeneration or maldevelopment in utero accounts for a number of cases, heredity and maternal disease for a few and familial jaundice for at least an occasional one. Until better observations are made at the time of delivery, the etiology cannot be determined satisfactorily, but the treatment is not altered by ignorance of the cause. This discussion is limited to cerebral palsy of congenital origin.

The number of patients with cerebral palsy is not known. There is reason to believe, however, that it closely approximates the number suffering from infantile paralysis. Records in the clinic of the University of California Hospital for the last five years show the two figures to be about equal, there having been no severe epidemic of anterior poliomyelitis. Lord² in 1932 noted that in Massachusetts alone 1,046 patients with cerebral palsy between the ages of 6 and 16 years reported for educational advice to the department of public welfare. In Minnesota³ in October, 1937, 1,117 of 8,500 crippled children were handicapped by cerebral palsy. Such figures are appalling and demonstrate the need both for such preventive measures as may be possible and for more interest on the part of physicians and educators in preparing to assist parents in handling such difficult problems as these patients present.

By the very nature of the condition the lesion is permanent and non-progressive. It may be diffuse rather than localized, as a result of the apnea which is frequently caused either by the hemorrhage which results in increased intracranial pressure or by multiple petechial hemorrhages throughout the tissues of the brain. Localization of the lesion, therefore, is likely to be much more difficult than it would be in an after following a cerebral accident. Even though the clinical symptoms suggest diffuse damage it is well to try to place the most important lesion as nearly as possible.

Cerebral palsies may be classified according to motor disturbances as spasticity, athetosis, chorea, rigidity, tremor and ataxia, and this classification is of value in determining the treatment.

In spastic paralysis, tension of the so-called posturing or antigravity muscles is increased. These muscles maintain the standing position, and so spasticity of the adductors of the thigh and the extensors of the knee and of the foot is present. As the arms do not assist in maintaining a position of standing, they are not extended, as in the quadriplegic, but are adducted at the shoulders with elbows partially flexed, forearms pronated, wrists flexed and fingers extended. The physiologic reflexes are hyperactive, and such pathologic reflexes as the extensor response of the great toe and clonus are obtained. The antagonistic muscles are frequently weak. In this type of disturbance the principal lesion in the brain is found in the motor or premotor cortex, where voluntarily planned movements are initiated. Fulton⁴ further subdivided this syndrome, stating that injury to the motor cortex or pyramidal tracts results in weakness, awkwardness and flaccidity of the corresponding limb, while injury to the premotor cortex causes spasticity and an increase in the reflexes. It is rarely possible, however, to make this differentiation clinically.

In athetosis or chorea, control of associated movement in the affected part is lost, and involuntary movements are increased by effort or emotion. The condition may involve only one limb or the entire body. Frequently, involvement of the facial and cervical muscles results in grimacing and uncontrolled movements of the head, and the muscles of articulation may be so affected as to make speech difficult or impossible. Drooling is frequent because of the difficulty in swallowing. The damage to the brain must occur in the basal ganglions, the so-called extrapyramidal system. The athetotic and choreiform movements, therefore, probably result from impulses, arising in the higher centers, or cortex, which fail to receive controlling stimuli from the basal ganglions in response to the afferent stimuli which are responsible for associated movements. These impulses travel along the extrapyramidal tracts.

Tremor is caused by the alternating contraction of agonists and antagonists, which may be slow or rapid, while rigidity is caused by a confluence of the contractions resulting in an apparently simultaneous contraction of agonists and antagonists. The lesion responsible for this state is presumably in the basal ganglions.

Incoordination, or ataxia, is relatively rare among those persons with congenital lesions, being found more commonly in progressive disease. Loss of position and loss of balance are present, with uncertainty in movement and loss of the finer movements. The lesion is in the cerebellum, the cells of which receive stimuli from bones and muscles and relay impulses to the anterior horn cells for control of balance.

Intelligence

An accurate determination of the true intelligence of the patient is absolutely essential before any plan of treatment can be formulated. The estimated intelligence of a specific child afflicted with cerebral palsy varies tremendously from "bright" or "normal" to "idiocy," depending largely on the emotions of the person making the decision. Parents and untrained social workers usually overestimate the intelligence of the child, while even scientifically trained examiners may be led to a certain extent by their emotions and to an even larger extent by the general appearance of the patient.

As the lesion is in the cortex in spastic paralysis, some degree of mental retardation is to be expected. On the other hand, unless diffuse lesions in the cortex are combined with the damage to the basal ganglions, normal intelligence should be expected in patients with athetosis, chorea, tremor or rigidity. Yet children of this group are often classed as idiots because of the marked facial distortion, drooling and inarticulateness.

Although the intelligence quotient can be obtained by such standard tests as the Stanford Binet or Stutsman scale, these tests may not give a sufficient lead as to educability. Reading, writing and arithmetic are essential; particularly for the child with a motor handicap, reading is important. Inability to read because of visual disturbances makes training almost impossible. The difficulties in visual discrimination may result from muscular imbalance, incorrect motions of the eye, reversal of visual imagery or inability to interpret pictures. Astereognosis, the inability to recognize objects by tactile sense, is sometimes present and may be responsible for the child's inability to draw figures or to copy letters; hence writing and the taking part in active games and in construction are practically unattainable, as the position of objects in space cannot be determined. Arithmetic, too, is necessary to any activity in the community. Loss of visual discrimination, astereognosis and lack of arithmetical ability are seen most often in the child with a cortical defect rather than in the one showing obvious damage to basal ganglions. These are defects that the medical examiner could well determine, though it is usually left for the well trained mental examiner or teacher to make the discovery.²

It is evident, then, that before any prognosis can be given, or any plan of treatment prepared, an accurate test of intelligence must be made by one especially trained and experienced in the handling of such children. In addition to the formal tests, the psychologist may be assisted by reports of the mother or the teacher as to changes in behavior and as to abilities. In many clinics adequate study of the child from a psychologic point of view can be made, and the child's future program will be influenced markedly by the results of this psychologic investigation.

Encephalography,⁵ though dangerous even in skilled hands, may give much valuable information. The degree of atrophy noted in the films assists in determining whether or not extensive therapy should be planned. It also may prove to doubtful parents that definite loss of tissue has occurred and that acceptance of medical advice is necessary.

Treatment

Treatment of the child with cerebral palsy must depend on accurate diagnosis of the type of palsy present, the severity of the condition and the mental status. If the child is mentally defective to a marked degree no elaborate program should be arranged, and if the parents are willing such a child should be placed in an institution, as family life is badly disturbed by a feeble-minded child and particularly by one with severe motor incoordination as well.

Cerebral palsy requires a therapeutic program of many years' duration, and accuracy of diagnosis both physically and mentally is necessary to intelligent planning. One may be able to aim toward economic independence for the child, but even though the mental capacity is adequate, the physical disability may prove too great a handicap for competition with the normal worker. Forcing the child only leads to his unhappiness. Usually a plan that will make him physically more independent in the home and promote good social and emotional adjustment should be the first aim, for this will

give both himself and his parents the greatest degree of satisfaction. The child must learn to walk and to care for such needs as feeding and dressing himself. If he can assist others with the routine work of the day, it is an added satisfaction. He must be as normal physically, intellectually and emotionally as his handicap will permit him to be, and neither less nor more should be expected of him. If he shows interest in special lines, assistance can be given, but if he works only to be thwarted, the achievement is not worth the price. The educational program is not a part of this paper except as it is connected with physical therapy.

Physical therapy is of infinite value to the patient with cerebral palsy, the aim being to reeducate muscles to carry out movements approximating normal patterns. By far the largest number of children requiring treatment are spastic or athetotic.

Spasticity may involve all extremities, the terminology being "quadriplegia" or "tetraplegia." Ford⁶ expressed preference for "diplegia" to indicate this condition when the legs are more seriously involved than the arms and "double hemiplegia" when the arms are more involved than the legs. "Monoplegia" indicates the involvement of one limb and "hemiplegia" the involvement of the arm and leg on the same side. The condition may be so slight as to be difficult of detection in one child, while in another standing, walking or using the hands is almost impossible. The child with quadriplegia stands with the hips moderately flexed and externally rotated, the legs adducted so that the thighs press together or cross, the knees flexed at from 15 to 20 degrees, the tibias showing torsion and the feet in a position of equinovalgus. The spastic muscles, then, are the adductors of the hip, the quadriceps femoris and the gastrocnemius-soleus group. Weak gluteus medius and tibialis anticus and posticus muscles are found. Since the arms no longer assist in the standing position they are held with the shoulders adducted, elbows flexed, forearms pronated, wrists flexed and fingers extended. The opposing muscles vary from weak to normal, with rare spasticity in opposing groups. It is advisable to keep a record of the power of the muscles, grading them as "spastic," "weak" or "normal." Such a record is of value, for it is often necessary to protect the weaker muscles as is done in flaccid paralysis. The spastic muscle resists stretch after the first 5 or 10 degrees of movement, owing to a reflex contraction of the muscle, "the stretch reflex." With application of further force, the muscle suddenly relaxes, owing to the "lengthening reaction" set up by excessive stretch, which stimulates the self-inhibiting afferent nerves in the muscle. To work toward a more normal movement one must obtain relaxation of the spastic muscle and contraction of the weak one, which under normal conditions occur because of reciprocal innervation of the muscles but which require reeducation under abnormal conditions. The aim is not to stimulate further contraction by passively stretching the spastic muscle if relaxation in it can be obtained by calling for contraction of its antagonists and simply assisting the latter in moving the joint. Cooperation of the patient is needed at the earliest possible age and must be obtained through games, plays, rhythms and the like.

Treatment should begin as soon as the condition is diagnosed. In the infant, passive stretching of a spastic muscle does not bring forth the resistance found at a later age. If therapy is started early enough, contractures are prevented. As the cortex or perhaps the pyramidal tracts have been damaged, movement of a large part or the whole of an extremity occurs, since there is loss of the voluntary control which is needed for fine movements and coordinations. Large muscles are trained first, therefore, and as im-

provement occurs an effort is made to obtain finer movements of the hand and foot and, if possible, contraction of individual muscles. Because strange surroundings and, particularly, sudden noises cause a marked increase in the contraction of spastic muscles it is usually better to explain the condition to the mother and to teach her how to train the child.

A plan for the daily program, which must not last over an hour, is as follows:

1. Place the child on a firm bed or on a mat on the floor, where he will feel secure. The room must be warm and the environment quiet so that attention will not be distracted. If treatment is given at home he should be placed in warm water as a preliminary measure to obtain as much relaxation as possible. If the therapy is carried out in a department of physical therapy, radiant heat should be applied for from fifteen to thirty minutes while the child is lying quietly in the place where further treatment is to be given. The therapeutic pool is sometimes beneficial, the temperature being between 95 to 102 F. Relaxation is sometimes obtained more easily than in the gymnasium, and the exercises are carried out under water.

2. This may be followed by light stroking massage which can be directed in a smooth, slightly curved direction either up or down the extremity. It must cause relaxation. If it fails to do so its purpose is lost and it should be stopped. Light tapping (tapotement) massage to the spastic muscles may cause them to relax. If it proves stimulating it must be stopped. Deep kneading of the weak muscles may have some value. The technic of massage is not simple and has to be most carefully applied to obtain satisfactory results, particularly because it is so easy to stimulate overirritable muscles rather than to cause them to relax. It is far better not to use massage than to fail to accomplish the desired result.

3. Directed movements are of the greatest importance. The heat, massage and arrangement of environment are only preparation for the exercises. Exercises are done slowly, smoothly and rhythmically, and as resistance of the opposing muscles is encountered, the movement is stopped and the limb carried back to its original position. As the movement is repeated a greater arc may be obtained before there is contraction of the opponents. The resistance met with is, as previously stated, caused by stimulation of the "stretch reflex." As the child recognizes the movement he will gradually relax the contracted spastic muscles, permitting the range of movement to increase. The following exercises are suggested, since they call for action of the "normal" or "weak" muscles and relaxation of the spastic ones most often found in the spastic child. They counteract the most common contractures because they are in line of direction of the weakest muscles and oppose the spastic ones.

1. With the child lying on his back, carry the arms sideward and upward to the overhead position.

Better relaxation of the adductors may be obtained if one arm is moved at a time. The arms may be alternated or carried together. Action of the deltoid muscle, the external rotators of the shoulder and the supinators of the forearm is desired.

2. Extend the elbow.

The arm is grasped just above the elbow while the forearm is extended on the humerus. Relaxation of the biceps muscle and contraction of the weak triceps muscle is the aim.

3. Supinate the forearm.

The elbow is at first flexed to a right angle, the forearm then being supinated. The flexed position causes less stimulation to the spastic biceps,

which is also a supinator. Later, the elbow may be extended at the side and the forearm supinated.

4. Dorsiflex the wrist.

The elbow may be flexed, and the fingers should be as relaxed as possible. If they tend to extend they should be passively held in partial flexion.

5. Dorsiflex the wrist and flex the fingers, keeping the thumb abducted to lie over the fingers.

This movement is important. The spastic wrist usually remains in palmar flexion, and as the child tries to grasp an object this flexion is more marked. Since a strong grasp by the fingers depends on a dorsiflexed wrist, this coordination must be taught if possible.

6. Separate the legs.

One leg can be abducted at a time, and this usually results in less spasm in the adductors of the hip. Later, the legs may be alternated and finally carried together. The leg should always be grasped above the knee so that no force is exerted on the knee joint, which might result in increased valgus.

7. Flex and extend the knees.

When the child begins to do this alone, the quadriceps femoris muscle may not be able to extend the knee fully against gravity. The child may be turned on one side and permitted to extend the knee on a smooth surface.

8. Dorsiflex the ankle.

The leg is grasped just above the ankle and the foot under the tarsometatarsal region (arch). This is important, as grasping the toes and metatarsal bones tends to cause a movement at the tarsometatarsal junction resulting in a "rockerfoot" rather than a movement at the tibioastragaloid joint.

9. Invert the foot.

This movement is in the line of contraction of the tibialis anticus and posticus muscles. The foot is grasped as before. The exercise may be combined with dorsiflexion of the ankle when the gastrocnemius-soleus muscles will extend sufficiently to permit it. The tibialis posticus muscle can contract fully with the foot extended, but the tibialis anticus cannot contract normally until the extensors of the ankle relax.

10. With the child lying face downward, hyperextend the legs at the hip.

Because of the weak gluteus maximus muscles this maneuver is difficult as an active exercise, and so only one leg should move at a time. As the child shows evidence of attempting the movement alone, he may be placed on one side so that the leg can be moved free of the pull of gravity.

11. With the child lying face downward, dorsiflex the cervical portion of the spine and arch the back.

This movement strengthens the extensor muscles of the spine so that the head can be supported in the upright position and a sitting position may be attained.

The child's interest should be obtained as soon as possible so as to eliminate passive movement and work through assisted active to active, to resistive exercises. To make the exercise into play he may be asked to reach for a bright rattle, ball or other toy, to play a singing game or to try to kick a ball. When interest is aroused and the child begins to cooperate and to attend instruction, a rather spectacular improvement is often noted and active movements become much better controlled.

As the muscles of the neck become strong enough to balance the head in the upright position, the baby should be placed in sitting posture well supported by pillows or tied firmly into a chair to give him a feeling of security, as the fear of falling must be overcome. Even at an early age, it is well to place him on a pad on the floor, where he can gain independence

of movement in a location free from the danger of falling. Though sitting, crawling, standing and walking are all retarded, opportunity should be given for the child to pass through these phases as normally as possible.

Certain surgical operations, such as lengthening of tendons, division of motor nerves to spastic muscles (Stoeffel), division of muscles and fusion of joints, such as the wrist or tarsus, may be of benefit. Surgical intervention should be resorted to, however, only after careful muscular reeducation has shown the need for the operation selected, and the program of muscular training must be resumed as soon as possible after the operation. Only too often children are seen who were taken into the hospital without previous care, were operated on, perhaps had braces applied after operation and then were dismissed with no arrangement for muscular training. The benefits of such treatment are minimal.

Braces are often necessary after an operation. In selected cases they are beneficial in preventing contractures, in training the child to a sense of correct position and in giving weak muscles necessary protection. They are used to extend the wrist and the knee and to prevent equinus. If the brace is applied firmly the muscles will relax, thus overcoming the "stretch reflex." Some children can walk only with straight leg braces and canes or crutches. If after other therapy has had sufficient trial these supports offer the only opportunity for the child to walk, they should be applied.

Athetosis may occur with spasticity, and tremor or rigidity may be present. When various types of muscular disturbance are in evidence it is assumed that the lesions are diffuse rather than localized. One may also suspect that intelligence is decreased by reason of cortical lesions. On the other hand, if the damage is fairly well localized in the extrapyramidal system (basal ganglions), one can expect a fairly normal mental rating even though the entire body is affected. As previously noted, children with athetosis are more likely to be considered feeble minded than are those with spastic paralysis; so, first of all, the mental status must be determined. Like the movements of spastic paralysis, the athetotic movements may be minimal or they may be so severe as to involve the entire body.

The fundamental principle of treatment lies in obtaining complete relaxation. No voluntary movement can be completed unless the involuntary motions can be controlled. Control by effort, which means by tightening, is impossible. Relaxation of the entire body must be obtained first; then the movement of volition may be begun with some hope of successful completion. Treatment should start as soon as the diagnosis is made. In the treatment of spasticity fair results may be expected even though treatment is not begun until the child is 8 or 10 years of age, but by the time a child with athetosis has reached such an age he has so many bad habits and training in relaxation is so difficult that the amount of improvement to be expected is greatly decreased.

In order to learn to relax, the child is placed on a bed or on a pad on the floor, where all fear of falling is removed. The room must be warm and quiet, all extrinsic disturbances being eliminated as nearly as possible. This permits rest, since children with athetosis relax perfectly during sleep. As the child becomes old enough to understand, he is asked to sink deep into the bed or pillows, to let the arm or leg "go to sleep" or, as Mrs. Fischel says, go "flop." Much time must be spent in this training for relaxation alone, though no single period should exceed an hour. Relaxation is important in order not only that voluntary movement may be attained but that the necessary rest for the overstimulated child may be secured. The training in the relaxation of muscles described by Jacobson⁷ is an excellent method

when the child is old enough to understand what is meant by tension and release of tension. It is usually best to start with the larger muscular groups and to work gradually toward the smaller muscles of the hand, face, throat, tongue, etc.

If the distance to a department of physical therapy is not too great, more may be gained by having the child come in from one to three times each week. The amount of time spent in the department will depend on the adequacy of the program at home. If the parents are intelligent and willing to give the time required to train the child, it is best to have him come to the physical therapy technician for treatment just often enough to assist the parents with their problems and to show them how to proceed. If the child reaches a standstill at home, the stimulation of the physical therapy technician may be helpful. On the other hand, many of the children who are brought long distances at intervals of two to three months seem to make progress that compares well with that made by the children who receive more frequent direction in a department. The mothers rely much more on themselves and, once suggestions are made, carry them out, fitting them to the individual child and his particular surrounding with remarkable intelligence.

After the child is relaxed completely the program of exercises described for children with spastic paralysis, consisting of flexing, extending, abducting or adducting large joints, is begun. These are passive at first, but later the child is asked to assist in carrying out the movement. "Overflow," that is, movement occurring in other extremities or parts of the body when a single movement in one limb is requested, must be avoided or bad habit patterns will be fostered.

As the child reaches kindergarten or school age, games in which several handicapped children participate are valuable. These can be arranged in schools for crippled children or in hospital schools. This type of activity permits great variation and takes the mind of the child from himself to the game, and movements are freer and better directed. Musical instruments, tricycles and even bicycles can be managed when the interest in attainment of skill is present. Again, the skill demanded must not be so great as to discourage the child.

If after careful treatment the child with athetosis cannot learn to walk or sit quietly, the question arises as to the next procedure. The patient who has not learned to walk by the age of 6 years even though he has had careful training requires a searching review of all the possibilities of his care and a decision as to its future conduct.³ There are no surgical procedures that are entirely satisfactory in improving the motor control of children with athetosis. Ablation of the corresponding motor cortex reduces the involuntary movements of an extremity and causes an incomplete paralysis. Horsley⁸ described this operation after he had relieved the athetotic movements in a patient with only one arm involved. Bucy and Case⁹ advised this procedure only in unilateral athetosis. Naffziger¹⁰ has performed ablations with satisfactory results. Putnam¹¹⁻¹² devised an operation in which the extrapyramidal tracts of the cord at the level of the second and third cervical vertebrae are sectioned. Use of this operation has been advised both for those in whom the entire body is out of control—to reduce the involuntary movements and permit the patient to sit or lie quietly—and for those in whom only one limb is affected. Distinct improvement has been reported.

Though one hesitates to place braces on an athetotic child for fear of causing further stimulation and irritation, there are a few patients who are aided by them. One does not hesitate to tie children into chairs and

to fix the feet to the chair so that the involuntary movements of the trunk and legs will be controlled sufficiently to allow concentration on the arms and permit purposeful movements to be performed. The brace need cause no more irritation than any other type of restriction. The child who is generally athetotic, unable to sit alone—much less stand—can, with straight braces on both legs, move about the house in a walker constructed to prevent falling. The walker may consist of a circular board with a hole in its center, to which are attached four lightweight metal rods which curve downward and outward to the floor and rest either on small wheels or on gliders. The base must be broad enough to make the walker stable but small enough to let it pass through doorways. The child stands in the center, the board acting as a circular shelf reaching almost to the axillas for the arms to rest on. Even though bracing is generally unnecessary, stiff leather supports reinforced with light soles of metal made over plaster of paris molds of the feet give good stability and may assist the patient to walk.

A small group of children suffer from other manifestations of cerebral palsy. Marked weakness is seen in a few. Aside from a small number of exercises that may improve the posture of the trunk and feet, little is to be offered. The child with ataxia probably has damage to the cerebellum. Training in balance is required, and so he is taught to walk along lines and to use the Frenkel apparatus. Those with tremor and rigidity are trained in relaxation and are managed in much the same way as those with athetosis.

Although the same exercises may be used in training a child with an extrapyramidal defect as are given the one with cortical damage, the approach and the response to the training are different in the two types. If the handicap is slight, the child may reach normal efficiency; if it is marked, one must avoid not only underrating what may be accomplished but setting too high a standard. The program, then, for the child who is severely crippled by cerebral palsy aims to achieve, first of all, independence in the home. The exercises given, therefore, are directed toward the prevention of contractures and toward practical useful movements to enable him eventually to care for himself and to assist in the home. The second objective is social adjustment and emotional stability. This usually necessitates avoidance of competition with normal children and of demands that tax the child beyond his ability.

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PHYSICAL THERAPY IN THE TREATMENT OF NERVOUS DISORDERS

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Destructive lesions of the central nervous system, whether they are of inflammatory, degenerative, vascular or neoplastic origin, are not capable of restitution. Therefore regeneration is not influenced to a great degree by treatment. Reversible reactions of the tissues surrounding a destructive lesion produce disturbed function, which recovers as soon as the reaction subsides. The problem in all later treatment with physical therapy is directed toward overcoming the residual disturbed function, which manifests itself clinically as a change in the tone or strength of the skeletal muscles, as impairment of sensation or as variations in the carrying out of co-ordinated movements. The production of deformities, contractures and changes in attitude, posture or gait are common resultants of these conditions. The rational use of physical agents requires a correct analysis and interpretation of the disturbance of physiologic function.

It is customary in the analysis of motor dysfunction to separate lower motor neuron diseases from those that involve the upper motor neuron. The former result from pathologic change in the anterior horn cells of the spinal cord or the motor nerve fibers to the skeletal muscles. This produces a flaccid type of muscle paresis or paralysis. It is accompanied by atrophy, loss of tone of the affected muscles and reduction or loss of the tendon reflexes. The overstretching of the weak muscles by their stronger physiologic antagonists permits the development of contractures in the shortened muscles and fixation or stiffening of the joints in undesirable positions. In the early stage of treatment it is essential to place the affected extremities in splints that prevent overstretching of the weak muscles. The splints, preferably of the half-shell type, must be well padded with cotton to prevent chilling of the skin and pressure of the bed covering or splints. The graded use of radiant heat from a light cradle, baker or radiant lamp can be started at the beginning of treatment for continuous periods of thirty to sixty minutes. Several times a day the muscles and joints are carried through full passive movements to prevent contractures of the muscles or stiffening of the joints. The amount of exercise is increased as recovery takes place. Massage is begun with gentle superficial stroking of the overlying skin after the heat and exercises. After the stage of muscle tenderness is passed the massage can be gradually increased in strength to compression or kneading movements. The presence of voluntary motor power calls for graduated exercises within functional limitations. The exercises must be given with the correct position of the extremity maintained by the assistance of the person giving the treatment. Fatigue and pain must be avoided, and the assistance or resistance provided by gravity is utilized. The operator can also offer assistance or resistance to the muscle in carrying out therapeutic exercises. Muscle strength can be developed only by active exercise. Cold agents, such as the cold shower or plunge, are used for their vasomotor effects and reflex tonic action on the reduced muscle tone in the later stages of treatment.

In diseases of the upper motor neuron, the segmented reflex arc in the spinal cord loses the inhibitory influence of the higher motor centers, espe-

cially the voluntary motor impulses which descend by way of the pyramidal tracts from the central cortex. This results in reduced or lost voluntary motor power and increased tone or spasticity of the affected muscles. The extremities assume a characteristic postural pattern, for example, the "hemiplegic posture." The tendon reflexes are greatly exaggerated, and pathologic reflexes, such as the extensor plantar response (Babinski sign) or spinal automatisms are released. The muscles do not become atrophic except from disuse, although they are weak or paralyzed to voluntary effort. Contractures of the shortened muscles and stiffening of joints tend to occur. The increased muscle tone depends to some degree on cutaneous reflexes (chilling of the skin) and to a greater degree on stretching of the affected muscles or their respective tendons (stretch reflex). In some cases of upper motor neuron disease the paralysis is of the flaccid type. Examination will usually reveal that the patient has an associated sensory defect, especially of the sense of position. In man permanent hypotonia occurs only in association with lesions of the postcentral gyrus. Lesions of the central gyrus, contrary to Fulton's results in apes, produce spasticity, as do lesions of the premotor cortex.

The treatment of upper motor neuron lesions is directed toward overcoming the contractures produced by the excessive tone in certain muscles. In the upper extremities, the tone is greatest in the adductors of the upper arm, the biceps, the pronators and the wrist and finger flexors. In the lower extremities, the leg is extended and adducted at the knee and the foot is plantar flexed and turned in. Three times a day radiant heat from a lamp or light cradle is given for thirty to sixty minutes to relax the muscles. The spastic muscles and joints are then slowly but firmly stretched several times through their full range of motion. Massage will not injure the muscles in spastic paralysis and may be given before or after the stretching procedures. The use of cold agents or faradic stimulation tends to increase the muscle tone and is not recommended in the treatment of spastic conditions. Active exercises of the weak or paralyzed muscles are begun as soon as recovery permits and are carried out daily. Attention to the postural changes is given with an aim to overcompensate for the changes in gait or posture. This establishes new habits, which require much conscious effort and practice before the pathologic postural pattern can be overcome. All the voluntary power regained by recovery should be utilized. Exercises and walking before a full length mirror will aid the patient in recognizing the faulty coordination produced in part by the released postural patterns. For example, the hemiplegic patient is trained to flex the knee in walking instead of permitting the extended spastic leg to be swung outward in an arc. In flaccid paralysis of the upper neuron type the degree of sensory loss, especially as to movement and position, is determined. This may have more influence on coordination and motor function than the motor weakness itself. The use of Frenkel exercises, to be described later, is recommended in the treatment of such paralysis. When there are sensory defects as to pain and temperature the danger of burns must be constantly kept in mind. Splints and braces are used in the treatment of flaccid paralysis of both upper and lower motor neuron origin. Heat, massage and exercises, as described, are employed. Cold baths or showers and stimulation with the faradic current are used in the treatment of flaccid paralysis for reflex stimulation of muscle tone.

Muscle tone is a complex phenomenon and must be considered from a broad viewpoint. It is controlled not only by the afferent sensory impulses of the spinal reflex arc but by vestibular and midbrain reflex centers. Diseases that interrupt the spinal reflex arc, whether they are sensory (tabes

dorsalis), motor (poliomyelitis) or combined sensory and motor (peripheral neuropathy), produce a loss of muscle tone, with impaired or absent tendon reflexes. This is likewise true of diseases of the muscles themselves (muscular dystrophies). The muscle tone is reduced in diseases of the cerebellum, in certain diseases of the extrapyramidal motor system, such as chorea minor, and in diseases involving the parietal sensory cortex. In states of shock of the central nervous system from injury, vascular accident or increased intracranial pressure the muscle tone is reduced, but this is often only a temporary physiologic state. In cachexia, chronic infections, toxemias or glandular disorders, such as Addison's disease, some degree of hypotonia of the muscles may be present.

Muscle tone is increased in diseases or lesions that release the primitive reflex arc from the inhibition of the higher nerve centers. Increased muscle tone accompanied by exaggerated and pathologic reflexes occurs below the level of a spinal cord compression, or transverse lesion, in pyramidal tract disease or in conditions that produce physiologic decerebration. A particular form of spasticity occurs in parkinsonism, or Parkinson's disease. Increased tone also occurs in parathyroid tetany and in strychnine poisoning.

In general, muscle tone is improved by stimulating procedures that act on the spinal reflex arc. The local or general application of cold in the form of baths or ablutions provides an adequate stimulus. Unless other factors contraindicate its use, the faradic current applied with the roller type of electrode is employed for the same purpose.

The examination for impaired sensation is important if dangers from the use of physical therapy are to be avoided. Impaired sensation may account for severe accidental burns. It may account for the failure of the patient to recognize pain during manipulative procedures. Denervated areas of the skin show poor resistance to pressure or heat and may easily become the site of decubitus ulcers.

Involuntary, incoordinate movements and tremors aid in making a neurologic diagnosis but are difficult to treat. In chorea minor the movements are quick spasmodic jerks that involve one muscle group after another and are accompanied by muscular hypotonia. The face in severe cases shows grotesque grimacing, smacking of the lips and sweeps of the tongue in various directions. Spasmodic tics are easily recognized by their constant repetition as a fixed pattern in a single muscle or group of muscles. Athetoid movements are involuntary movements that have a slow twisting, or vermicular, character. Movements that carry out jerky wide swings of an entire extremity are called hemiballismus. In parkinsonism there is a steady rhythmic tremor present while the extremities are at rest. It is accompanied by muscular rigidity, a masklike facial expression and the loss or reduction of such automatisms as blinking, swallowing and swinging of the arms in walking. In senile or familial tremor there is no muscular rigidity, masking of the facies or loss of such associated automatisms. In Huntington's disease the choreiform movements include peculiar gestures or jerks that involve large muscle groups, especially the girdle musculature. Active motion exaggerates incoordinate movements or tremor in multiple sclerosis. In cerebellar disease the swaying or drunken gait and the tendency to overshoot the mark are not corrected when the eyes are open as they may be when the incoordination is the result of loss of position sense. Characteristic types of station and gait aid greatly in the recognition of many organic nervous diseases.

Physical therapy procedures will now be considered under individual disease headings.

Brain Diseases

Hemiplegia. — This is perhaps the most common neurologic disorder the physician is called on to treat. It may follow a variety of pathologic processes but in the majority of cases is the result of thrombosis, embolism or hemorrhage of one of the cerebral arteries. The immediate and the residual functional impairment as well as the prognosis are determined by the type and extent of the central lesion. It is wise to remember that a cerebral vascular accident does not invariably signify a bad prognosis. Hemiplegia in most cases is accompanied by an initial period of shock. The flaccid stage may be transitory, or it may last from four to six weeks. During this stage the paralyzed members are treated by procedures similar to those described for flaccid paralysis. The arm should be placed on a pillow and maintained in a position of abduction and partial external rotation of the shoulder joint. The foot should be supported to prevent foot drop. Bilik¹ places the forearm in supination and the hand and fingers in hyperextension. The foot is splinted to prevent the equinus position. Some physical therapists give the flaccid muscles of the face and extremities a number of contractions with the interrupted faradic or sinusoidal current until the stage when voluntary power or spasticity returns. In the later stages of treatment the residual changes determine the procedures used. In typical spastic hemiplegia the varying degree of motor weakness to voluntary muscle activity is overcome so far as possible by a program of active exercises, which are gradually substituted for passive motion and massage. The increased muscle tone is enhanced by stretching the muscles by cold agents or chilling of the skin and by the faradic current. Radiant heat and superficial stroking massage tend to reduce the tonicity and are indicated as procedures preliminary to active exercise, whereas electrical stimulation is no longer advisable. The hemiplegic postural changes are treated by overcompensation for the postural defects and require the active cooperation of the patient. Assistive exercises may be necessary early, before the patient has strength enough to carry out active exercises unassisted. These can be done in bed. Reeducation for active movement is soon introduced into the program of exercises. Coulter² recommended the following procedures, a few of which can be done four times daily.

Arm Exercises: Movements in single joints are first taught with the other joints uncorrected, patient lying down.

Movement in Single Joint: One other joint is held correctly.

Two-Handed Stick Exercises: The patient grasps a broom handle with both hands. The hands are close together, so that the sound arm can assist the affected arm: (a) elbow flexion and extension; (b) wrist flexion and extension; (c) raise the arms above the head with elbows extended.

Weight and Pulley Exercises: The weight is used to assist the weak muscles to overcome the spastic muscles.

Ball Exercises: Throw and catch a ball. Pick up and put down the ball.

Finger Exercises: Keep time to music with individual fingers. Play checkers or taroms. Do typewriting. Stretch the fingers apart on marks on a board.

Leg Exercises: Joint movements are practiced with the patient lying on his side: first movement in one joint, then movement in one joint with another held corrected, and, finally, the whole limb.

Chair Exercises: Rise and sit down. Feet under the chair, rise by bending forward and straightening the hips and knees.

Ball Exercises: Kick a ball, while sitting and standing, into designated boxes.

Walking: Watch to overcome defects. Try to flex the knee and dorsiflex the ankle. Step over books. Walk up and down steps.

Bilik recommended in addition straight line walking, heel-toe exercises, exercises for abduction and external rotation of the hip and correct walking. He suggested symmetrical exercises, of the two limbs working in unison, graded in intensity to meet the requirements of the individual patient. The movement should be carried through a full arc and be directed toward correct form rather

than toward the easiest way. Daily treatment must be continued over a long period.

In the treatment of flaccid hemiplegia, if there are sensory changes the use of heat must be carefully regulated to prevent burns. As a rule the patient shows more recovery than the spastic patient. The general plan of treatment is the same as for spastic hemiplegia. Use of the interrupted low frequency current for muscle stimulation and procedures to increase muscle tone are added. It is often necessary to give the flaccid paralytic extremity additional support with an arm sling or with braces to cock up the wrist or prevent foot drop. Prevention of joint changes is important.

Bilateral hemiparesis occurs in cases of multiple sclerosis and in cases of deep-seated softening of the frontal lobes. In the latter cases there may be associated reflex grasping, pseudobulbar palsy and pathologic laughing or crying. As a rule in such cases the prognosis is unfavorable. Hemiplegia associated with aphasia may be difficult to treat because of the inability of the patient to comprehend the plan of treatment.

Diseases of the Extrapyrarnidal Motor System

Diseases of the extrapyramidal motor system have been divided into two groups. The hypokinetic-hypertonic group, of which parkinsonism is the best example, is characterized by the triad of spasticity, tremor and loss of associated automatisms, such as swallowing, blinking and swinging the arms in walking. The hypotonic-hyperkinetic group, represented by chorea minor or athetosis, has muscular hypotonia and excessive motor activity due to purposeless or involuntary muscular contractions. The symptoms of both groups are exaggerated by emotional excitement.

In the hypertonic-hypokinetic conditions both medicinal therapy and physical therapy are purely symptomatic. Heat applied by an infra-red lamp or short wave diathermy several times a day will aid in the relief of increased muscle tone and pain. A light cradle placed under the bed covering is a simple means of providing heat for hours at a time. Warm relaxing baths have the same purpose and may be given as follows: Place the patient in the bathtub with the water at a temperature of about 36 C. (96.8 F.). Slowly add hot water for five minutes, until the temperature of the bath is not over 42 C. (107.6 F.). The patient remains in the bath for about five minutes and is then quickly dried and placed in warm blankets. This procedure should not be used if the patient is debilitated or has cardiovascular disease. Heat may be supplemented with superficial stroking massage and forced motion to stretch the spastic muscles and prevent joint fixation. Motor reeducational exercises are given to teach the patient to overcome voluntarily the defective gait by flexing the knees and swinging the arms in walking.

In the hypotonic-hyperkinetic group, the motor hyperactivity of chorea minor has been benefited by artificial fever therapy. The treatment does not seem to benefit the reduced muscle tone, and it is questionable how much it influences the frequently associated rheumatic infection. In the convalescent stage, cold showers, if not contraindicated because of cardiac damage, are an excellent tonic for the reduced muscle tone. In the treatment of athetosis accompanied by muscular hypotonia, voluntary relaxation is developed. Muscular coordination is then taught while an attempt to inhibit the involuntary movement is being made. The results of such treatment are influenced by the degree and the nature of the underlying disease. Tics are rapid, constantly repeated muscular contractions which occur in a certain unchanging group of muscles. They are aggravated by embarrassment or other emotions. Some examples are blinking of the eyes, grimacing and twisting of the jaw or shoulders. The treatment

consists of reeducational exercises and methods to establish more poise. The reeducational methods utilize exercises of inhibition. The patient is instructed to preserve immobility so that useful correct movement can be carried out. This can be done before a mirror where the patient can observe his reactions. If frequently repeated attempts at inhibition of the tic finally enable the patient to remain motionless for as long as five minutes, he can begin to carry out useful movements while keeping immobile. These should at first be done on muscle not involved in the tic, and the movements should be carried out slowly and accurately. If the tic is facial, the exercises should include moving the arms and legs, walking, standing and sitting. This accomplished, the patient can begin to carry out simple movements of the affected muscles. The movements should be done only a few times and should be increased in number and complexity as time goes on. Such exercises should be done three to five times a day in front of a mirror, usually before some member of the family who can supervise the patient. Never permit exercises to the stage of fatigue. The physician should check the results periodically. He can then change, amplify or modify the exercises, which should be written out specifically as a daily routine.

Establishment of more poise can be brought into the program by occupational or recreational methods. It would necessitate group activity, which tends to reduce the emotional reactions. A course in public speaking could be a final test. These procedures need not interfere with a program of psychotherapy, which is often necessary.

Diseases of the Spinal Cord

The spinal cord not only serves as a medium of conduction of sensory impulses to the brain and of efferent impulses away from the higher centers but is a complex reflex organ that acts more or less independently when cut off from other structures. Diseases of the spinal cord may selectively injure both motor and sensory structures or involve various combinations of each. A consideration of the treatment by physical therapy of several relatively clearcut types of disease will establish principles which can be applied as indicated to more complex combinations.

Tabes Dorsalis. — The lightning pains and tabetic crises produce much suffering that stubbornly resists treatment. In some cases short wave diathermy over the spine at the segmental zone indicated may give considerable relief. Care must be exercised to prevent burns, as partial anesthesia over the zone may be present. The ataxic gait and poor coordination in carrying out motor activity are the result of loss of joint and position sense. The reeducational exercises described by Frenkel train the patient to utilize to the maximum degree what position sense he has left. Visual fixation is substituted for position sense in maintaining spatial orientation. Coordination, not motor power, is the aim of treatment. The exercises do not influence the pathologic changes or courses of the diseases associated with the loss of position sense. The exercises are useless unless some sensory stimuli carrying joint or tendon sense reach the higher cognitive centers. Concentration on repeated muscular movements train the mind to recognize minimal degrees of sensation. Such exercises lead to rapid fatigue, which must be avoided. It is best to begin treatment with a few simple exercises not repeated too frequently. The following exercises, described by Coulter,² will serve as a guide.

Exercises in the Recumbent Posture. — Exercises for the lower extremities in the recumbent position should be given on a smooth, hard bed. The patient, with head propped up so that he can see each movement, is given an explanation of the purpose of each procedure. Emphasize slow, deliberate and correct form and the avoidance of fatigue.

Position: Lying on the back, legs on a smooth sheet or oilcloth in extension and in apposition; head raised on pillows.

Each exercise four times, repeated every three hours.

1. Flexion of leg at hip and knee joints, heel sliding along the bed but not lifted. Return to original position.

2. Flexion as before, and from flexed position abduction, return to flexed position, and return to original position.

3. Flexion of leg at hip and knee to half the angle in exercise 1 and return.

4. Repeat exercise 2 to half the angle.

After several days or a week, depending on the progress, the following exercises are given every three hours and the original ones only once daily:

1. Flexion of one leg at the hip and knee joints; stop at any position in either flexion or extension when "halt" is called by some member of the family.

2. Flexion of the legs simultaneously in the hip and knee joints.

3. Flexion of both legs at the hip and knee joints and from the flexed position abduction to the normal angle (not to the maximum range). Return to the flexed position and extension.

4. Flexion of the two to one-half the angle of exercise 2.

As progress goes on the next group is started:

1. Flexion of both legs to one-half angle; abduction in this position; return to the flexed position, and extension.

2. Flexion of both legs; stop at any angle in flexion or extension when "stop" is called by a member of the family.

3. Flexion of both legs at the hip and knee joints; abduction from this position; return to flexed position, and extension. Stop and continue at command in any angle.

4. Flexion of both legs to one-half angle; abduction from this position, return to the flexed position, and extension. Stop and continue at command.

Exercises are now started that require lifting of the extremity from the bed. They introduce the need for balance as well as joint motion. They can be modified by commands to start or stop at different angles.

1. Flexion of one leg at the hip and knee with the heel raised from the bed.

2. Flexion of one leg with the heel brought to rest above the patella.

3. Flexion of one leg with the heel brought to rest on the patella.

4. Flexion of one leg with the heel brought to rest on the middle of the tibia.

Tabetic patients tend to exaggerate movements to compensate for loss of joint motion. They experience more difficulty in carrying out slight movements that require movement of the joints through large angles.

1. Original position; flexion of one leg at the hip and knee with the heel brought to rest on top of the ankle of the other leg; return to the original position.

2. The same as exercise 1 except that the heel comes to rest on the toes of the other foot.

3. The same as exercise 1 except that the heel is first put on the patella of the other leg, raised and rested on the middle of the tibia, raised to the ankle joint, lifted again to the toes and returned to the original position.

4. The same as exercise 3 except that the inverted order is inverted.

The next group is more difficult:

1. Original position; the heel of one leg is put on the middle of the tibia, raised and put by the side of the leg and then extended.

2. The heel is placed on the ankle joint and then placed by the side of the other leg; the leg is then flexed at the hip and knee joints and extended.

3. The same as exercise 2 except that the heel is first placed on the toes of the other foot.

4. The heel of one leg is placed on the other knee, raised and placed on the bed by the side of this joint. The leg is extended and the heel placed on the middle of the tibia; the leg is raised and placed on the bed by the side of the other leg. Repeat for the ankle joint. Vary this by inverting the order.

The next group requires continuous maximum accurate coordination with a minimum of muscular contraction.

1. Original position; the heel of one leg is placed on the opposite knee and then is moved down the crest of the tibia to the ankle joint and the leg is extended. Repeat in reverse order.

2. The same as exercise 1 except that the heel slides along the tibia and foot to the toes. If the heel reaches the toes of the other foot, the leg of this foot must be flexed slightly at the knee joint. Repeat in reverse order.

3. The same as exercise 1 except that the heel slides along the tibia to the middle, stops, continues to the ankle joint, stops and continues to the toes as in exercise 1.

4. The same as exercise 1 except that the movement is stopped and continued at the command of some member of the patient's family.

Tactile impression aids in controlling movement in the next series.

1. Both legs are flexed at the hips and knees, with the malleoli and knees in apposition and then extended.

2. The same as exercise 1 except to half the angle.

3. The same as exercise 1 except that voluntary halts are made.

4. The same as exercise 1 except that the exercise is stopped and continued at the command of some member of the family.

The next exercises are given so that one limb performs one movement while the opposite limb executes another movement.

1. Both limbs flexed; one remains flexed while the other is extended, heels touching the bed.

2. Both limbs are flexed and extended, with the heels raised during extension.

3. The same as exercise 2 except that the heels are raised during flexion.

4. Both limbs are flexed and extended with the heels kept off the bed during both movements.

The next series is more difficult.

1. One leg is first flexed and then abducted while the other leg is flexed. The abducted leg is then adducted while the other is extended. Return to the original position.

2. The same as exercise 1 except that when the legs are extended the heels are raised from the bed.

3. One leg is flexed in the knee and hip joints and then extended without touching the bed while the other is flexed, abducted and then adducted.

4. One leg is flexed in the hip and knee joints while the other is flexed, abducted and adducted. The two legs are brought together in the flexed position and extended without touching the bed.

The next series is directed by a member of the patient's family.

1. The member of the family places the tip of his finger on various places on the patient's leg, and the patient tries to put his other heel on this finger.

2. The same as exercise 1 except that the moment the patient tries to put his heel on the finger it is moved to another place, and the patient tries to follow its course without touching it.

3. The patient tries to place his heel in the hollow of the hand of the other person, and the position of the hand is constantly changed.

Exercises in Sitting Posture. — These exercises are designed to reeducate the patient in changing from the sitting to the standing position and vice versa.

Sitting-down exercise:

1. The knees should be slightly flexed.

2. The body is slightly bent forward.

3. The patient begins to sit down, continuing the flexion of the knees and the bending of the body. The body should be kept bent over until the patient is actually in the chair.

The tabetic patient cannot balance himself on his toes but needs the whole foot. In rising the body is bent forward so that the center of gravity is above the heels.

Getting-up exercise:

1. The feet are drawn back until the heels are partly under the chair.

2. The body is then bent forward.

3. The patient rises by extending the knees and slowly straightening the body.

Exercises in the Erect Posture. — The exercises are given on a bare floor. The eyes are fixed on the feet and the exercises are carried out slowly. A cane or walking rail may be necessary. Walking sideways is easier for tabetic patients than walking forward and may be practiced first.

1. Walk ten steps forward on the floor where lines 14 inches apart have been drawn. The patient should be instructed in the correct use of the legs.
2. The same as exercise 1. Correct the outward rotation of the legs.
3. The same as exercises 1 and 2. Keep the legs so that the distance between the heels is not more than 6 inches.

In the next exercises the length of the step and the width of the walking base are varied. A normal step is 28 inches. The distances used are marked on the floor with chalk.

1. A half-step forward with the feet placed in apposition after each step. Walk ten steps in this manner.
2. Ten half-steps, as in walking.
3. Quarter-steps forward ten steps with the feet placed in position after each step.
4. Quarter-steps forward ten steps, as in walking.
5. Alternate half-steps and quarter-steps with the feet brought together after each step. Ten steps.

The use of the eyes as a substitute for the position sense to preserve orientation in space is cultivated. The treatment aims to have the patient abandon the dependence on vision if possible.

1. In walking, after the patient is proficient he is asked to look at the ground in front of him instead of at his feet. Then his former tendency to walk quickly and the outward rotation of leg appear again.
2. Next, the patient is asked to keep his eyes fixed on the wall near the floor.
3. The eyes are fixed on the wall near the ceiling.

Ataxia in the upper extremities is treated by the same principles as those described. Catching suspended balls, piling disks on one another, putting the fingers or pegs in holes numbered in a perforated board, following movements of objects with the fingers and touching spots drawn on a blackboard are suggestions of methods that can be used.

Frenkel exercises are useful in the treatment of combined cord disease of pernicious anemia, neuritis of the lower extremities, injury or myelitis involving the posterior columns and Friedreich's disease.

Syringomyelia. — This disease causes destruction of the spinal cord, especially in the lower cervical region near the central canal. Hemorrhage from any cause in the same region produces hematomyelia. The symptoms in the early stage include loss of pain and temperature sense with preservation of posterior column sense. Extension of the process leads to atrophy and weakness of the intrinsic muscles of the hands, trophic and vegetative disturbances (increase or loss of sweating, changes in the skin and nails, Charcot's arthropathy) and increased reflexes or spasticity in the lower extremities. Clawing and contractures in the hand and accidental burns frequently occur. The management of the motor disturbance is the same as that described on pages 482 and 483 inclusive. Avoidance of burns or trauma to insensitive areas and care of the skin are necessary.

Combined Diseases of the Posterior and Lateral Columns. — The classic example of this disease occurs in pernicious anemia. The same areas of the cord may be involved in some cases of other nutritional deficiencies, arteriosclerosis of the spinal cord, leukemia, meningomyelitis of syphilitic or tuberculous origin, Hodgkin's disease and other conditions. The posterior column disease producing tabetic-like symptoms is combined with bilateral pyramidal tract degeneration in the lateral columns. Whether the clinical picture is primarily of the spastic or the ataxic variety depends on the relative degree of involvement of the posterior or lateral columns. For the ataxic condition the treatment is the same as for tabes dorsalis (page 487), and the treatment of the pyramidal tract disturbance is the same as for upper motor neuron lesions (page 483).

Anterior Horn Cell Diseases. — These are pure lower motor neuron diseases recognized as an acute infection in anterior poliomyelitis or as a chronic

systemic degeneration in progressive spinal muscular atrophy. The treatment of poliomyelitis is described briefly on page 482.

Progressive Spinal Muscular Atrophy. — In this disease the muscular weakness and atrophy progress slowly over a period of months or years. There may be remissions or stationary periods in individual cases. The muscles lose their tone, fibrillary twitching is present and the tendon reflexes are diminished or absent. The muscles show the reaction of degeneration in the electrodiagnostic tests. The use of electrical stimulation of the muscles as a therapeutic measure is of little benefit. Heat, massage and carefully controlled therapeutic exercises are of more value. Active exercise is carried out cautiously to avoid strain and fatigue of the weak muscles. Measurement of the circumference of the atrophic extremities at intervals is an accurate way to determine the course of the disease.

Muscular Dystrophies. — This group of diseases is treated by the same methods used in the management of the spinal muscular atrophies. The familial incidence, absence of fibrillary twitching in the involved muscles, pseudohypertrophy of certain muscles and absence of the reaction of degeneration make differentiation from the muscular atrophies possible.

In the treatment of lower motor neuron diseases and the muscular dystrophies attention must be given to the correction and support of postural deformities.

Amyotrophic Lateral Sclerosis. — This is a progressive disease that runs a rapid course in from twelve to thirty-six months. Treatment is symptomatic and of little benefit. In typical cases there develop weakness and atrophy of the intrinsic muscles of the hands of lower motor neuron origin as the result of degeneration of the anterior horn cells in the cervical portion of the cord. The atrophy may advance up the arms to the shoulder girdles. The lower extremities become spastic because of bilateral pyramidal tract degeneration. Death usually occurs as the result of respiratory failure or bulbar palsy which occurs late in the course of the disease. The treatment is similar to that given for other upper and lower motor neuron diseases.

Primary Lateral Sclerosis (Charcot's Disease). — In most cases this disease is the result of multiple sclerosis. A bilateral degeneration of the pyramidal tracts in the spinal cord produces a spastic weakness of the extremities. Treatment is the same as for other upper motor neuron paralyses.

Multiple Sclerosis. — In the spinal cord the plaquelike lesions may involve any of the structures in both gray and white matter. The treatment has to be altered to fit a given case. The principal symptoms are referable in some cases to the cerebellar tracts or the posterior columns and in others to the pyramidal tracts; or there may be a mixture of sensory defects and motor changes. The use of heat, massage, therapeutic exercises and muscle training are used as the need may be. An important and frequently neglected therapeutic procedure for this disease is complete bed rest. Spontaneous remissions may bring credit to the physician for a therapeutic result with which he had nothing to do.

Transverse Lesions of the Spinal Cord. — Transverse cord symptoms occur in acute myelitis from compression of the spinal cord by tumors after injuries and from other causes. In the initial stage there is a flaccid paralysis below the level of the lesion. The extremities require support, massage and passive exercises. Sensory loss below the level of the lesion is conducive to trophic skin changes and decubitus ulcers. Disturbed bladder function gives rise to urinary retention, incontinence and ascending urinary infection. In fatal cases sepsis following skin infection or ascending urinary infection is a frequent cause of death. The return of reflex cord function below the level of the lesion results in spinal automatisms and spastic paralysis. These changes produce contractures

or deformities that require preventative treatment. Pressure over the sacrum, trochanters and heels should be prevented, and the skin requires scrupulous care. As voluntary power returns the paralytic members are carried through exercises and muscle reeducation to promote as much usefulness as possible. Walking with crutches or a cane with mechanical leg braces for support is preferable to permanent invalidism in a bed or wheel chair.

Peripheral Nerve Lesions. — Peripheral polyneuritis can be differentiated from a segmental radiculitis or neuritis of a single nerve. Polyneuritis involves all four extremities and is produced by the ingestion of a toxic agent (lead, arsenic), by a nutritional deficiency (avitaminoses, chronic alcoholism) or by infection (diphtheria, typhoid). The spinal nerves exhibit initial irritability characterized by sensory paresthesias, such as tingling, prickling or burning sensations, and the muscles may show fibrillary twitching and mild weakness. This is superseded by loss of sensation and motor paresis or paralysis. The paresthesias are replaced by the loss of sensation to touch, vibration and position. Painful stimuli still produce a disagreeable diffuse response, but the threshold to stimulation is elevated above the normal level. In severe cases all sensation and motor power are finally lost, impairment being most pronounced in the distal parts of the extremities. Sensory recovery occurs in the reverse direction; that is, response to painful stimulation returns first. Polyneuritis may be very mild, involving only sensation, or it may be severe enough to produce complete paralysis. Recovery in severe cases depends on the causative factor but under the most favorable circumstances requires weeks or many months. Neuritis or neuropathy involving a single nerve is usually produced by pressure on the nerve at a point where it passes close to underlying bone or solid structures. The most commonly involved nerves in pressure neuropathy are the radial, ulnar and external peroneal nerves. Other nerves may be injured by fractures or other types of severe trauma. All peripheral neuropathies are treated by the same physical therapeutic procedures, namely rest, protection, heat, massage and muscle exercises and reeducation. In the first three to six weeks the weak muscles are set in a neutral position by splints, which protect them from overstretching. The splints are padded with cotton to protect the skin from pressure. A light cradle placed beneath the bed covering provides added warmth and protection of the skin, which is very sensitive to touch or pressure. Several times a day the splints are removed and gentle passive motion is given to the muscles and joints, care being taken to avoid stretching. Gentle superficial stroking massage may be added as soon as the patient can tolerate it without pain. The massage is given with the flattened palm of the hand held loosely and carried through long sweeps in one direction. Later on the patient will be able to tolerate kneading of the muscles, which at first are sensitive to pressure. Some physical therapists recommend warm baths or moist applications several times a day in the treatment of polyneuritis. Short wave diathermy given daily for ten to fifteen minutes at half the usually given strength provides an effective method of deep heating. Stimulation of the muscles with the sinusoidal low frequency current after four to six weeks has its adherents. The recent experimental work of Chor and his associates³ casts doubt on the usefulness of electrical stimulation. Their work indicates that massage and passive motion will do as much or more good. If voluntary muscular contraction is not lost, or as soon as it returns, exercise and reeducation of the muscles are instituted.

Peripheral Facial Nerve Palsy (Bell's Palsy). — The paralytic muscles can be protected against overstretching by adhesive strips attached to the angle of the mouth and carried upward to an elastic band or bandage around the head. The conjunctiva and cornea are protected from irritation by the wearing of sun glasses and the instillation of saturated boric acid solution in the eye several

times a day. Radiant heat is applied to the affected side of the face for ten to twenty minutes twice a day. This is followed by superficial massage with stroking in the direction of the action of the paralyzed muscles. The patient should be cautioned not to rub or massage the face himself. Unipolar stimulation of the weak muscles with the galvanic current at the end of ten to fourteen days is advocated by most authorities. Only a few contractions are given at the first treatment, and thereafter they are gradually increased in number. After voluntary contraction is possible, exercises before a mirror are given several times a week. The exercises include elevating the brows, closing the eyes, showing the teeth, smiling, whistling and blowing out of the cheeks. The exercises and massage may be taught to the patient, who can carry out the procedures several times a day at home. Recovery in the average case requires from one to nine months, depending on the degree of initial paralysis.

Psychiatric Conditions

Acute Alcoholism. — Physical therapy is useful as a part of the eliminative measures used in the detoxification of patients with acute alcoholism. For the promotion of diaphoresis and relaxation the relaxing bath described on page 486 is given several times a day. If the pulse rate rises to over 150 per minute the bath is discontinued. After the patient is in bed an ice bag is placed on the forehead, and hot sweetened tea or lemonade is given in liberal quantities. After the toxic symptoms have disappeared cold showers and active outdoor exercises are beneficial.

Insomnia. — The relaxing hot bath similar to that used for alcoholic patients promotes sleep when given just before going to bed. The diaphoresis induced may not be desirable in chronic cases. The neutral bath, in which the temperature of the water is between 35 and 36.7 C. (95 and 98 F.), may be preferable. The patient remains in the bath twenty to thirty minutes with an icebag to the head. A hot drink or cold compress over the abdomen just before retiring sometimes produces relaxation.

The Psychoneuroses. — Physical therapy is not a substitute for psychologic therapy in the treatment of the psychoneuroses. It may be a valuable adjuvant to other methods of treatment but must always be prescribed according to the need in a given case. Diethelm⁴ said: "The individual's personal history explains various types of sensitiveness to different situations in life. No physiotherapeutic procedures can be administered in their best form and the results evaluated if this is not considered carefully." He pointed out that emotional factors in a given case may interfere with the results of treatment. It is important to know something about the patient's attitude toward himself, toward the outside world and toward the physical therapist giving the treatment. The personality of the therapist plays an important role. Some of the factors that influence the choice of therapy are the self confidence, self depreciation, self pity, need for praise or encouragement, introspectiveness and anxiety of the patient. The "body-conscious" patient may develop a greater fixation on a certain part of the body if the physician directs too much concern toward that part. This may intensify rather than dispel false belief about organic changes. The skin acting as an erotic zone may produce pleasure when stimulated. The patient may easily develop the physical therapy habit as a means to vicarious pleasure, and physical therapy, especially massage, may represent a compensation for repressed or poorly adjusted cravings. In that type of patient physical therapy tends to perpetuate the neurosis. Technicians are familiar with the patient who enjoys massage but will utilize every means of resistance to avoid a program that includes active exercise. Unless individually determined psychodynamic factors point to a different plan, it is better to prescribe therapy that will make the

neurotic patient do something for himself. In other words, it is better to work some of the neurosis out of a patient than to rub it in. Billings⁵ stated that massage is contraindicated in the treatment of certain personality disorders, including homosexuality, agitated depression with an increased sex urge and certain hysterical reactions with localized involvement of a part of the body, and for patients who become dependent on the treatment.

The use of the warm relaxing bath or the cold pack for tense or excited patients, of active exercise preferably in the form of occupational or recreational activity, of rest and relaxation (such as Jacobson's⁶ progressive relaxation methods) have all earned a well deserved place in the therapeutic program for the psychoneurotic patient. Massage should be prescribed and supervised by the physician who knows the type of personality disorder, can predict the effect of treatment and can explain the problem to the technician. Little can be said to be in favor of the old method of jarring the hysterical patient out of his symptoms with the painful faradic current. This procedure is psychologically unsound and contributes to the development of conversion symptoms that may be more disabling than the original condition.

1500 Professional Building.

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ARCHIVES of PHYSICAL THERAPY

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.. EDITORIALS ..

PREHABILITATION

Now that the life of the whole nation is being geared to the total war effort, it is proper to inquire what physical therapy can do to help. This question is discussed by Krusen in an article appearing in this issue of the ARCHIVES. He has used Rowntree's term "prehabilitation" to indicate the correction of physical defects in the unfit. Up to the time of the presentation of his paper, 10.8 per cent of the young men called in the draft had been rejected because of musculoskeletal abnormalities in which physical therapy and occupational therapy are particularly helpful. The venereal diseases caused another 6.3 per cent of rejections. Some of these could be prehabilitated with fever therapy. It is probable also that isolated cases in the other categories mentioned in the paper could be greatly benefited by physical measures.

Although the people of the United States have for many years become increasingly health conscious, the onset of the war has accentuated that trend. Unfortunately, a considerable portion of the so-called health education comes from pseudo-scientific sources. Had a definite planned effort to improve the nation's health been started twenty years ago, the story of draft rejections would be quite different. Improved nutrition and dental hygiene would have prevented a large portion of the 20.9 per cent of dental defects. Many of the 10.8 per cent of musculoskeletal abnormalities might have been remedied earlier in life. It has been shown 80 per cent of the students entering our schools and colleges have poor posture. Careful medical supervision during childhood would doubtless decrease somewhat the 10.6 per cent of cardiovascular disabilities. Even mental and nervous diseases in draftees could probably have been reduced by expert medical care in earlier years. The good results obtained in the fight against tuberculosis should be an object lesson in the prevention and care of other disabling diseases.

It is to be hoped that "prehabilitation" will not stop with the present war effort, but that it will continue as an organized effort to improve the health of the American people. In such a campaign physical medicine should play an important role.

SUNLIGHT AND PERNICIOUS ANEMIA

The relation of radiant energy to hematopoiesis has been the subject of many experimental studies. Owing to several variable factors, results have been conflicting. Among the variables are: sources of radiation with qualitative and quantitative differences, diverse climatic conditions, and variations in experimental subjects as to genus, health and food supply. The sun's radiation varies with the time of day, the season, the latitude, the altitude and the atmospheric conditions. Although experimental results have

been conflicting, it is generally agreed that anemic persons show more marked increases in red blood cells and hemoglobin than normal persons.

Although, as Laurens¹ has said, pernicious anemia is not ordinarily thought to be benefited by radiant energy, there are some reports which suggest that sunlight, or a closely similar artificial radiation, may have a definite influence on blood regeneration in this disease. About the time of the introduction of liver therapy in the treatment of pernicious anemia, Heuer² presented 5 cases in which sunlight or carbon arc radiation had been employed to produce definite increases in the red blood cells and the hemoglobin. The excellent results obtained with the new liver therapy apparently caused Heuer's report to pass with scant notice.

A few years later Smith³ presented a statistical study on the relation of the intensity of solar radiation to the death rate in pernicious anemia. By using climatic data from the United States Weather Bureau Stations at Madison, Wisconsin; Lincoln, Nebraska; Washington, D. C., and Key West, Florida, he developed an "index of radiation" by combining the angle of incidence of the sun's rays, the percentage of possible sunshine and the humidity. Using this index, he was able to show that the pernicious anemia death rate was inversely proportional to the intensity of solar radiation.

Apperly⁴ recently approached the same problem from a different angle. Since the incidence of skin cancer is directly proportional to the amount of solar radiation, he plotted the skin cancer death rate from various localities against the pernicious anemia death rate and obtained an even more definite inverse relationship than had Smith with his "radiation index."

Just how sunlight may influence hematopoiesis has not been made clear. Apperly tried to explain this action of sunlight as in some way related to the argentaffine cells described by Jacobson.⁵ These cells occur in portions of the gastrointestinal mucosa from which the antianemic substance is derived. They contain in their cytoplasm yellow fluorescent granules which take a silver stain. Jacobson found argentaffine cells absent or almost absent in each of 12 pernicious anemia patients coming to necropsy. Apperly suggested that there might be some connection between the "dopa reaction" described by Arnow⁶ and the fluorescent granules of the argentaffine cells. It will be remembered that Arnow described the conversion of tyrosine to 3-4-dihydroxyphenylalanine ("dopa") by ultraviolet radiation. Dopa is changed to melanin by dopa oxidase. Such an explanation of the action of sunlight in pernicious anemia seems highly speculative.

Whatever the mode of action of heliotherapy in Addisonian anemia, the evidence presented by Heuer, Smith, and Apperly indicates the desirability of further investigation. Present liver therapy is extremely effective, but it is possible that heliotherapy might be valuable adjuvant treatment.

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SISTER KENNY AND THE KENNY METHOD

Like most radical departures from routine therapy, the Kenny method for the treatment of poliomyelitis has stimulated a great deal of discussion. The method has necessitated a drastic revision of our thinking concerning the disturbed neuromuscular physiology, the symptomatology and the treatment of the disease. Disappointments in the field of therapeutics are common and the medical profession is therefore justly conservative and often skeptical regarding new methods of treatment. This attitude, so long as it is not tinctured with prejudice, is a protection to the public against exploitation and careless experimentation.

The Kenny method has been studied in this country under the scrutiny of competent, open-minded medical observers over a period of two years. These observers have been convinced of its merits and on their recommendation, it has been officially recognized by The National Foundation for Infantile Paralysis. Its use is being initiated in various parts of the country.

It is often a slow and discouraging task for a physician to effect a change in established medical thought and methods. Many years of painstaking investigation, much medical writing and much courage and perseverance are usually required to gain the full approval and recognition of the profession. Against such a background, the achievement of the nurse, Sister Elizabeth Kenny, shines out with the greater luster. Her boldness and courage in discarding much of the established routine treatment of infantile paralysis and her perseverance in the face of opposition, reminds one of the same qualities in the life of Florence Nightingale. Through all of her long struggle toward final success, though often opposed by medical men, Sister Kenny has retained her loyalty to the profession. Scientific medicine, and especially physical medicine, is indebted to her for an epoch-making advance in the treatment of infantile paralysis.

Gustav Kolischer 1863-1942

Just as we are going to press we learn of the death of Dr. Kolischer one of our past-presidents. Although Dr. Kolischer has been in failing health, nevertheless his death came unexpectedly. An obituary will appear in the September issue.



MEDICAL NEWS

Scholarship Grants

Four additional grants totaling \$20,220.00 for the purpose of providing scholarships and training in the field of physical therapy—a field very important in the care of infantile paralysis—are announced by Basil O'Connor, President of the National Foundation for Infantile Paralysis, Inc.

The list of awards, including the purposes, the institutions and the amount of each award, follows:

D. T. Watson School of Physiotherapy — \$4,500.00.
Leetsdale, Pennsylvania.

To provide training in physical therapy for additional students.

The American Physiotherapy Association — \$5,000.00.

Stanford University, California.

To provide fifty scholarships for properly qualified students in physical therapy.

School of Health, Stanford University — \$6,920.00.
California.

To provide training in physical therapy for additional students.

Northwestern University Medical School — \$3,800.00.

Chicago, Illinois.

To provide training in physical therapy for additional students.

Since last May, the National Foundation for Infantile Paralysis has awarded grants totaling \$347,564.25 to carry on its research and educational programs.

The National Foundation for Infantile Paralysis leads, directs and unifies the fight against infantile paralysis by means of its research, epidemic and educational programs. It also provides medical, nursing and hospital care and orthopedic appliances for needy victims of the disease through its more than 2,400 Chapters.

The funds which made possible the Foundation's programs are raised annually during the various Celebrations of the President's birthday.

Tire Rationing Relations

So serious is the situation as regards rubber available for tires that the Office of Price Administration has made new regulations regarding the rationing of tires for motor cars of persons in the medical and religious profession. The regulations follow:

Office of Price Administration

An amendment to the tire rationing regulations, which tightens requirements in some respects and extends eligibility for tires to certain automobile

users heretofore not provided for, has been issued by the Office of Price Administration. The amendment:

1. Requires that a vehicle operated by a physician, surgeon, farm veterinary or practicing minister, to be eligible for tires and tubes, must be used "exclusively" for professional services or religious duties instead of principally" as heretofore.

2. Makes licensed chiropractors and osteopaths eligible under the same conditions as apply to doctors of medicine.

3. Extends the eligibility of ministers to "any religious practitioner qualified to administer to the religious needs of the members of a congregation."

4. Changes the designation of nurses eligible for tires from "visiting nurse" to "public health nurse."

5. Extends eligibility for recapped or obsolete new tires to public school officials and teachers for necessary transportation between schools.

The eligibility standards for doctors and ministers have been changed to require that applicants must show that the vehicle on which a tire or tube is to be mounted is necessary because there is no other practicable means of transportation. Heretofore the requirement was a showing that the car was needed and used in making professional calls. Even under the new standards, however, if it is necessary for the applicant to answer emergency calls as a part of his professional practice, he may be issued a certificate to enable him to use his car between his home, his office and hospitals.

In making osteopaths and chiropractors eligible under the same conditions as apply to physicians, the OPA recognized that there are substantial numbers of people who rely solely on the treatments of such practitioners.

The term "public health nurse" instead of "visiting nurse" was adopted to define more accurately the type of nursing service that makes an applicant eligible. Eligibility is not extended to any group not covered heretofore. The new term includes school nurses employed by boards of education for work with school children, visiting nurses employed by groups such as public health nursing associations, health department nurses, county nurses and industrial nurses, all of whom are employed for the purpose of making nursing or inspection calls for such agencies. — [Reprinted with permission, J. A. M. A. 119:895 (July 11) 1942.]

New Veterans' Hospital in Illinois

The Veterans' Hospital at Marion, Ill., for general medical and surgical patients has been completed at a cost of \$1,500,000. The new construction consists of a main hospital building to care

for 167 patients, dining hall and kitchen facilities, residences for staff officers and nurses, attendants' quarters, boiler house, laundry and garage. The five story main hospital and administrative building is faced with Indiana limestone and provided with polychrome terra cotta spandrels. The basement of the building is devoted to the physical therapy department, necropsy rooms and morgue and a chapel. The first floor is given over to administrative and clinical activity which include units for roentgen therapy, dental, eye, ear, nose and throat, laboratory work and examination. The second and third floors of the building are devoted to ward purposes, each floor being divided into two separate ward units completely equipped and staffed by a doctor and nurse. Operating rooms are located on the fourth floor. The main building can be expanded to accommodate about 400 patients by the construction of a wing at either end of the building. Space has been allowed for the expansion of all buildings in the utility group when this becomes necessary. To the rear of the hospital group will be three 392-bed barrack buildings for the care of domiciliary members. One domiciliary building will be built soon and the remainder at a later date, giving this facility an ultimate capacity of about one thousand five hundred and seventy beds. — [Reprinted with permission, J. A. M. A. 119:821 (July 4) 1942.]

New Journal

The International Journal of Sex-Economy and Orgone-Research is a new journal in the field of medicine. The first issue appeared in March, 1942. The Editor, Dr. Theodore P. Wolfe states "that this Journal presents a subject—its long history in Europe notwithstanding—is essentially new to American readers. It will undoubtedly raise numerous questions." The Journal is the official organ of the International Institute for Sex-Economy and Orgone-Research, of which Dr. Wilhelm Reich is the Director.

National Society for Crippled Children Supplies Literature

Of interest to crippled children workers is the May, 1942 bulletin on current literature of and about the crippled child. Any publication or article listed in the bulletin may be borrowed free of charge from the Bureau of Information of the National Society for Crippled Children, Elyria, Ohio.

Hospitals: Liability for Electric Lamp Burn

The plaintiff was admitted to the defendant hospital one morning preparatory to undergoing an operation. Sometime during the afternoon a hospital attendant attached an electric lamp and reflector to the bedstead at the foot of the plaintiff's bed. The lamp was attached by means of hooks similar to the ear bows of eye glasses. The operation was performed about 8 o'clock in the evening, under a spinal anesthetic, and the plaintiff was returned to his room an hour or so later. In the middle of the

night the plaintiff complained of a burning sensation in his feet. When the bed clothes were removed a nurse discovered the lamp which had formerly been attached to the foot of the bed. The plaintiff's foot had been seriously burned. Subsequently the plaintiff sued the defendant hospital for damages on account of the injuries sustained as a result of the alleged negligence of the defendant's servants. The trial court refused to submit the case to the jury and dismissed the plaintiff's complaint, so the plaintiff appealed to the Court of Appeals of New York.

The defendant contended that the trial court ruled correctly in dismissing the complaint because the plaintiff had not produced sufficient evidence to warrant the submission of the case to the jury. It argued that the plaintiff had not negated the possibility that the burn was caused by his own negligence or that of some one for whose actions the defendant hospital was not responsible. It also insisted that there was no proof that the burns were caused by the lamp. The Court of Appeals said that circumstantial evidence was sufficient if it supported the inference of causation, even though it did not negative the existence of a remote possibility that the injury was not caused by the defendant. The plaintiff's evidence, said the court, was sufficient, if believed, to show that the plaintiff was not burned when he was put to bed after the operation; that he felt the burn later, that the lamp was removed from under the bed clothes and that the burn was of the kind which could be caused by the lamp in question. Furthermore, said the court, it was unreasonable to assume that some complete stranger, or even the plaintiff's physician, entered the plaintiff's room during the operation and tampered with the bed lamp. The court therefore concluded that the plaintiff's evidence negated all but the barest possibility that the defendant was free from negligence and held that the case should have been submitted to the jury. The court also held, although the defendant claimed no immunity because of its charitable nature, that it is now well settled in New York that even a charitable hospital is liable for the acts of its servants. Judgment for the defendant was accordingly reversed and a new trial granted.—*Dillon v. Rockaway Beach Hospital & Dispensary*, 30 N. E. (2nd) 373 (N. Y., 1940).—(Reprinted with permission, J. A. M. A. 119:507 [June 6] 1942.)

Hospitals: Liability for Pneumonia and Tuberculosis Following Hydrotherapy Treatments

The plaintiff was suffering from a common cold and entered the defendant sanatorium. She was given hydrotherapy treatments. Subsequently pneumonia and then tuberculosis developed. Attributing these conditions to the negligence of the sanatorium, she brought suit against the institution. The trial court entered judgment against her, whereupon she appealed to the Supreme Court of Colorado.

The plaintiff's complaint alleged that the sanatorium was negligent in giving her "certain hydrotherapy treatments, which treatments consisted

of hot baths and hot water treatments, and thereafter failing to take reasonable precautions to observe whether or not the plaintiff was thoroughly dried before placing her in an open and extremely cold hospital room." Assuming, said the Supreme Court, that the hydrotherapy treatment was negligently given, followed by a lack of precautionary measures, there remains the question as to whether the negligence was the proximate cause of the pneumonia and tuberculosis. In order to sustain a charge of negligence as a basis for a legal remedy, the court pointed out, the charge must be fortified by reasonable certainties and not left open to conjecture and speculation. Furthermore, where the record is devoid of any evidence showing a probability of proximate cause, the question is one of law for the court, not of fact for the jury. In this case the court could find no evidence from which the jury could properly have found that the hy-

drotherapy treatment given by the sanatorium attendant, and other alleged acts of carelessness, were the "cause which in natural and continued sequence, unbroken by any efficient intervening cause, produced" the pneumonia and subsequently the tuberculosis. The most that could be said from all the evidence, including that of the medical expert who testified for the plaintiff, was that there was a possibility that the treatment may have been the cause. This was not sufficient. The contention that the undisputed medical evidence to the effect that it was possible for the exposure to have precipitated the pneumonia was equivalent to probable was in the opinion of the court untenable. The judgment in favor of the defendant was therefore affirmed. — *O'Connor v. Boulder Colorado Sanitarium Ass'n*, 111 P. (2nd) 633 (Colo., 1941). [Reprinted with permission, J. A. M. A. 119:830 (July 4) 1942.]

Physical Therapy in Cerebral Palsy — Baker

(Continued from page 481)

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BOOK REVIEWS

TEXTBOOK OF MEDICAL TREATMENT. By various authors. Edited by *D. M. Dunlop*, B.A. (Oxon.), M.D., F.R.C.P. (Edin.), Professor of Therapeutics and Clinical Medicine, University of Edinburgh; Physician, Royal Infirmary, Edinburgh; *L. S. P. Davidson*, B.A., (Camb.), M.D., F.R.C.P. (Edin.), F.R.C.P. (Lond.), Professor of Medicine and Clinical Medicine, University of Edinburgh; Physician, Royal Infirmary, Edinburgh, formerly Regius Professor of Medicine, University of Aberdeen; *J. W. McNee*, D.S.O., D.Sc., M.D. (Glas.), F.R.C.P. (Lond.), Physician, H.M. the King of Scotland, Regius Professor of Practice of Medicine, University of Glasgow, Physician, Western Infirmary, Glasgow, Consulting Physician, University College Hospital, London, with a Foreword by the late Professor *A. J. Clark*, B.A. (Camb.), M.D., D.P.H., F.R.C.P. (Lond.), F.R.S., formerly Professor of Materia Medica, University of Edinburgh. Second Edition. Cloth. Pp. 1179, with numerous graphs and figures. Price, \$8.00. Baltimore: The Williams & Wilkins Company, 1942.

Carefully edited by Doctors Dunlop, Davidson and McNee, the Textbook of Medical Treatment brings the modern and most accepted methods of treatment to the general practitioner. In this second edition, many changes have been made from the original text, necessitated by the war and the fact that drugs formerly produced by Germany are no longer available. However, in most instances a British equivalent is mentioned in place of drugs not obtainable from the original manufacturers. The war has produced many advances in medicine and these for the most part have been incorporated in the text. This comprehensive volume is not concerned with diagnosis, but is limited strictly to treatment, thus permitting a concise inclusion of medical therapeutics in only one volume. Each section in the book has been written by a man well qualified for his particular assignment and generally the authors give not only their own opinions regarding the most efficient form of therapy, but frequently they compare the results of the various therapies. Specialists may find some minor points with which to disagree, but the student and general practitioner will find its explicitness a valuable aid. The diction and some of the drugs prescribed are British, but the American equivalent for both the drug and the diction can readily be ascertained without confusion. The text describes in detail the medical therapeutics of all types of disease, but does not include the surgical treatment. Special chapters deal with the common diseases of the skin, venereal disease, metabolic, industrial and tropical diseases, as well as the common diseases encountered in everyday practice of medicine. Worthwhile contributions to the book are the sections on the diseases of the nervous system and psychotherapy. Also included are detailed instructions for many of the technical

procedures most textbooks take for granted that everyone knows and understands. Oxygen therapy too is explained in detail. The success which attended the first edition of this book and its reprint may well be understood, and it should be surpassed by the second edition if its value to the practitioner is to be a criterion.

FUNCTIONAL NEUROANATOMY. By *Wendell J. S. Krieg*, Ph.D., Assistant Professor of Anatomy, College of Medicine, New York University. Cloth. Price, \$6.50. Pp. 553, with 274 illustrations, plus section atlas. Philadelphia: The Blakiston Co., 1942.

The author has approached the subject of neuroanatomy from the functional or systemic viewpoint. Utilizing his long experience as a teacher, he has realized that the student must have a fundamental understanding of the embryologic development of the central nervous system both in the lower forms and in man before he can begin his arduous study of the spinal cord, the brain, the autonomic and peripheral nerves and their various interrelations.

The unusually clear diagrams, most of which are original drawings, help to clarify the text and enable the reader to follow the various nerves and nerve tracts to their nuclei in the spinal cord, brain stem and cortex. The use of phantom drawings is new in the reviewer's experience. One can look into the brain, as it were, and see the interrelations of nervous structures. This feature alone justifies ownership of the book.

While the study of neuroanatomy is long and arduous, yet this new book develops the matter in a clear and logical fashion. To medical students, neurologists, medical specialists and internists this book is highly recommended.

HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE COLITIS. Pp. 30. **HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE GALLSTONES AND DISEASES OF THE GALLBLADDER.** Pp. 41, 5 illustrations. **HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE MIGRAINE.** Pp. 37. **HELP YOUR DOCTOR TO HELP YOU WHEN YOU HAVE GASTRIC OR DUODENAL ULCER.** Pp. 53, 3 illustrations. By an Editorial Board consisting of *Walter C. Alvarez*, Editor-in-Chief; *George Blumer*, M.D.; *Logan Clendenen*, M.D.; *Irving Cutter*, M.D.; *Howard W. Haggard*, M.D.; *Rudolph Matas*, M.D.; *Charles W. Mayo*, M.D.; *George R. Minot*, M.D.; *John H. Stokes*, M.D., and *George H. Whipple*, M.D. In four individual volumes. Price 95c per volume. New York and London: Harper and Brothers, 1941.

Here is a series of miniature popular monographs which are short and readable and which can be read

profitably by physicians, their assistants and unhesitatingly recommended to their patients. They are being written with the idea of supplying answers to those questions that come crowding into the mind of a man or woman who has just been told by a physician that he or she has a certain disease. What the patient wants is authentic and up-to-the-minute information written in words simple enough for him to understand. With this information at hand he can do much to cooperate with his physician and to facilitate the cure of his malady. These books have been prepared by some of the ablest specialists in this country today and every statement in them has been checked and weighed. An effort has been made to differentiate what is known from what is commonly assumed to be true and the writer of each book has tried to avoid telling his readers to do this or that when he has no real proof that such orders are necessary. For several reasons it has been thought best not to publish the authorship of the books because it is believed that the eminence of the men on the editorial board will be a sufficient guarantee to the readers that the authors chosen were fully qualified to write what they have written. These books should meet the needs of the average layman better than does the old-fashioned "Home Doctor Book," because when he wants information it is usually about one disease; not about the whole field of medicine. Now he can get the chapter he wants without buying the whole big book. The short glossary at the end of each volume explaining the technical terms in it should be of definite help for the proper comprehension of contents.

THE VARIETIES OF TEMPERAMENT. A PSYCHOLOGY OF CONSTITUTIONAL DIFFERENCES. By *W. H. Sheldon*, Ph.D., M.D., Harvard University with the collaboration of *S. S. Stevens*, Ph.D., Harvard University. Pp. 520. 21 Tables. Cloth Price \$4.50. New York and London: Harper and Brothers, 1942.

The endeavor of this volume is to describe human beings in terms of their most deep-seated similarities and differences, so not only differentiation can be made between heredity and the effects of environment, but as a farther step the elemental or primary components of human variation can be measured. It is the second in a series of volumes describing the principal tenets of what the authors call a constitutional psychology; the first volume entitled "The Varieties of Human Physique" dealt with the basic differences in the physical structure of people, while the present volume deals mainly with the interrelation between morphologic characteristics and the more dynamic levels of personality. Its technic is to standardize the description of sixty traits—twenty of each in three correlated clusters—which collectively make up the scale for measuring what appear to be three primary components of temperament. The authors have named three correlated groups of traits, viscerotonia, somatotonia and cerebrotonia, and in a study extending through a period of five years two hundred young men have been morphologically and temperamentally analyzed and these analyses in the form of detailed case histories illustrate the effort to carry out the basic idea of

the authors. Physicians, nurses, social workers and others interested in present day methods of psychologic analysis should find this volume instructive and stimulating.

STEDMAN'S PRACTICAL MEDICAL DICTIONARY. By *Stanley Thomas Garber*, M.D. 15th Edition. Entirely reset. Fully Revised. With Thumb Index, \$7.50. (Without Thumb Index, \$7.00.) Semi-Flexible Leather. Illustrated. Baltimore: Williams & Wilkins, 1942.

Dr. Stanley T. Garber, nephew of the late Dr. Stedman collaborated with him on the fourteenth edition and now carries on with the new revision which shows many additions and revisions. Obsolete terms have been removed, illustrations have been changed as well as added to make this a valuable reference. In the Appendix there is included tables of weights and measures, comparative temperature scales, stethoscopic abbreviations, the important microparasites pathogenic for man and certain animals and what is especially valuable new nomenclature in Latin and English adopted by the anatomical society of Great Britain and Ireland with the Basle Anatomical Nomenclature (BNA) Equivalents. The choice of anatomical terminology is a difficult one for students as well as writers of medical literature. With the rapidly changing field of scientific medicine it is necessary to have the latest edition at hand for our daily use of an authoritative medical dictionary.

DIRECTORY OF MEDICAL SPECIALISTS CERTIFIED BY AMERICAN BOARDS, 1942. PUBLISHED FOR THE ADVISORY BOARD FOR MEDICAL SPECIALTIES. Directing Editor, *Paul Titus*, M.D. Cloth. Price, \$7. Pp. 2,495. New York: Columbia University Press, 1942.

This second edition contains complete information about more than eighteen thousand certified Diplomates. A separate section is devoted to each American Board, with both a geographic and a biographic listing of its Diplomates. In addition there is a complete alphabetic list of all the Diplomates. In this list there are addresses and indications of specialty certification, while in the geographic section complete biographic information is given. The organization and examination requirements of each of the American Boards are explained in full. This book is indispensable to all those in a position to need authoritative information about physicians in their specialties.

GOULD'S MEDICAL DICTIONARY. WORDS AND PHRASES GENERALLY USED IN MEDICINE AND ALLIED SCIENCES, WITH THEIR PRONUNCIATION AND DERIVATION. Edited by *C. V. Brownlow*. 5th Edition (1941). 174 Tables. Rigid or Flexible Covers. Plain, \$7.00. Indexed, \$7.50. Philadelphia: The Blakiston Co., 1941.

This new fifth edition contains thousands of new words and definitions. It shows the authentic pronunciation by a phonetic respelling of each word and gives a useful key to the pronunciation at the

bottom of each page. Many new illustrations have been added including a number of fine plates in color. The list of tables is especially inclusive. The Physician's Dose Table gives both the Apothecaries' and Metric equivalents. There is a Veterinary Dose-Table. Gould's Medical Dictionary is so well known that it hardly needs further introduction but that it has been brought up to date will be welcome information to all those who depend on this essential part of their medical library.

ILLUSTRATIONS OF BANDAGING AND FIRST-AID. Compiled by *Lois Oakes, S.R.N., D.N.* (Leeds and London). Formerly Nursing Editor, *Nursing Illustrated*; Late Sister-Tutor, Walton Hospital, Liverpool; County Organizer for the Civil Nursing Reserve, Cambridge; Examiner to the General Nursing Council. Illustrated with 300 photographs. Second edition, revised and enlarged. Price, \$2.00. Pp. 256. Baltimore: A William Wood Book. The Williams & Wilkins Company, 1942.

The object of this small volume is to instruct students, by means of a series of well taken photographs, in the art of bandaging and in first aid in fractures and hemorrhages. The illustrations are so arranged that every method of bandaging can be seen at a glance from start to finish. The book should fill a welcome role not only in instruction of nursing personnel but also in the now so popular courses of first aid instruction. A number of blank pages have been conveniently placed for the taking of notes.

PRINCIPLES AND PRACTICE OF ORTHODIGITA. By *Harry A. Budin, M.Cp.*, Head of the Department of Orthodigita, The First Institute of Podiatry, Long Island University. Cloth. Pp. 258, illustrated. Price, \$4.00. New York: Strathmore Press, 1941.

This book has been written primarily for the podiatrist. The author defines the practice of orthodigita as "a branch of podiatry practice concerned in the prevention, amelioration, and correction by non-surgical means, of toe deformities and malalignments, as well as the resultant lesions and other painful effects."

There are brief descriptions of the anatomy and physiology of the toes in conjunction with discussion as to the cause and classification of hallus valgus, hammer toes and overlapping toes. The major portion of the book deals with splints, pads, treatments used in these various deformities and malalignment of the toes, as well as with apparatus for the exertion of traction on the toes, stretching of the heel cords, proper footwear, use of low-voltage

currents, and corrective exercises used in these conditions. Many of the devices described can be applied for long periods both while the patient is wearing or is not wearing shoes. The devices are ingenious, interesting and inexpensive.

In reading the book the reviewer is impressed by the fact that no clinical data are given to serve to verify the remarks of the author as to the various procedures he recommends. However, this may be excused somewhat by the statements made in the preface; in which the author states, "whether or not to cite illustrative case reports was carefully weighed and it was decided that, at the present time, the inclusion of case reports would be gratuitous. The mention of a few cases is practically useless; while to report the number of cases sufficient to really instruct and exemplify would require so much space as to merely encumber, but never serve in lieu of, a concise, though complete, expository text—the prime need in an introductory volume. In last analysis, the most expedient road to acquisition of skill in this field is not by case reports, but by direct experiment with, and observation of, the techniques and appliances here suggested or that may be developed by other investigators." Yet the book might have been more valuable had space been used to report clinical experience.

The book is clearly written and illustrated, and should be of interest to those who practice orthopedics, physical therapy and podiatry. The author will have made a definite contribution by his book if he stimulates the study of nonsurgical procedures in the treatment of common, annoying abnormalities and deformities of the foot.

STANDARDS FOR DAY CARE OF CHILDREN OF WORKING MOTHERS. REPORT OF THE SUBCOMMITTEE ON STANDARDS AND SERVICES FOR DAY CARE AUTHORIZED BY THE CHILDREN'S BUREAU CONFERENCE ON DAY CARE OF CHILDREN OF WORKING MOTHERS. Paper. Price, 10 cents. Pp. 29. Burdau Publication 284, Washington, D. C.: U. S. Government Printing Office, 1942.

This committee emphasizes that mothers who remain at home to provide care for children are performing an essential patriotic service in the defense program. If mothers must work outside the home, special plans must be made to preserve the important elements of parent-child relations and family life during the hours when the family can be together. During the hours when the mother is working the children must be given care which supplements that given at home and which rounds out the plan for an appropriate twenty-four hour day for the child. This volume gives standards to apply to such day care of these children.



PHYSICAL THERAPY ABSTRACTS

Physical Medicine. A Review and a Policy. Sir Morton Smart.

Brit. J. Phys. Med. 5:60 (April) 1942.

Assuming that organization is essential to stabilize physical medicine under the control of the medical profession as a special branch of general medicine, the fundamentals of any action to bring this about must be on the basis of close relations between specialists in all branches of medicine, specialists in all branches of physical medicine, general medical practitioners, physicists, registered physical therapy technicians and manufacturers of medical apparatus. To coordinate and control activities and organize cooperation on broad lines such a powerful combination of interests the author feels is essential. This end, desirable from the point of view of the medical profession and the public alike, could best be attained by the formation of a society or institute of English-speaking physical therapy physicians. Members would be enlisted from those interested in the subject from Great Britain, The Dominions, the Colonies and the United States of America. As the result of recent correspondence with Dr. Richard Kovács, of New York, the author is encouraged to believe that such a liaison with our coworkers in the United States would be welcomed as a means of emphasizing our solidarity of aims in serving mankind and stimulating mutually the organization and development of sound physical therapy methods and of their practitioners. The main objects of an Institute of Physical Medicine would be:

1. Generally to organize physical medicine so that a complete trustworthy and efficient service to all branches of medicine and surgery may be provided and kept under strict medical control.

2. To establish a meeting place for (a) medical men who specialize in all branches of physical medicine; (b) specialists in all departments of medicine and surgery who are interested in physical medicine in the practice of their specialty; (c) general practitioners; (d) dentists interested in physical medicine; (e) physicists; (f) medical students; (g) members of the Chartered Society and Society of Physiotherapists.

3. To encourage the study by lectures and demonstrations of all branches of physical medicine in its medical, physical and biological applications and to take steps to bring before the medical profession generally the importance of the various methods and their advancement on a scientific basis.

4. To provide a center of information relating to physical medicine in all its branches available to all in Great Britain, the Dominions, Colonies and foreign countries.

5. To report periodically on all forms of apparatus and to evaluate the claims made for all forms of treatment.

6. To press for compulsory training of students in the rudiments of physical medicine.

7. To organize undergraduate and postgraduate teaching.

8. To institute research scholarships.

9. To cooperate with the staffs of hospitals, institutes, colleges and universities, so that they may assist the work of the Institute, by persuading them to recognize the status of the physical medicine specialists and assist in standardizing the range of services which hospitals should provide.

10. In collaboration with specialists in all branches of medicine and surgery who take advantage of physical medicine methods in the practice of their speciality to evolve a syllabus for a Diploma in Physical Medicine. The end in view would be the foundation of a Chair of Physical Medicine.

Treatment of Rheumatoid Arthritis in Children. Dermot Roden.

Brit. M. J. 4229:102 (January 24) 1942.

Heat to influence the local and general circulation may be applied in a number of ways.

Local heat should be applied for twenty to thirty minutes. It may be given by means of infra-red generators or electric bulbs. For home use small inexpensive electric heat sources are available, but an output of less than 250 watts is considered unsatisfactory. Hot paraffin wax is another good method of applying heat locally and is particularly useful in houses where there is no electricity. Some persons are sensitive to the wax, which may cause skin reactions. The use of diathermy is good for deep-seated joints but is expensive and therefore not practicable for prolonged use. For peripheral joints it has no advantage over the method previously mentioned.

General heating of the body is accomplished by several methods. (a) Short wave diathermy—i. e., placing an induction cable under a thin mattress on the treatment table and enclosing the patient in a very thick type of sleeping bag. (b) Radiation cabinet: if this is used the patient should be lying down and not sitting up, as is generally advised. The heat source is numerous carbon filament electric bulbs. (c) Immersion in hot water: this type of treatment will be dealt with later. (4) The most suitable method of producing general heating is by means of a hypertherm. The patient's temperature should be raised to about 103 F., but careful watch (especially in active cases) should be kept for intolerance — e. g., headache, vomiting, or vascular collapse.

It may not be out of place here to correct a widespread impression that massage and stretching can, *per se*, free stiffened joints—only further damage results. All the good effects following massage should be looked for in a betterment of the circu-

lation. In the acute phases massage should be applied with caution, and the edict, "Don't hurt your patient," is always pertinent.

Exercise and rest are of much importance in preserving the eventual function of the affected joints. The exercises must, however, be carefully graduated and supervised. The rule should be that if pain is present two hours after the exercises have been finished they were overdone, and the length of time spent at them and the range of movement attempted should be less on the next occasion. The exercises should be of the active assistive variety, attempting the normal range in all directions for the particular joint.

Hydrotherapy is of much value. The following measures are especially useful: Underwater exercises in a Hubbard tank, contrast baths and the use of a wet pack.

A general course of ultraviolet light given concurrently with other treatment helps to build up the patient's general resistance.

Ion transfer with vasodilating drugs such as histamine or acetyl-beta-methylcholine has been shown by Kovács to produce prolonged hyperemia of the joints in rheumatoid arthritis, but the author thinks it is indicated only where hyperemia fails to result from simpler methods.

Low-frequency currents, such as the surging faradic or sinusoidal, are occasionally of value by causing involuntary muscular contractions without movement in the limb which is often required when the joints are acutely affected and the limb has to be immobilized for longer periods than usual. They are also of value if a functional element is one of the causes of limitation of movement.

The Concurrent Treatment With Fever and Nearsphenamine of Experimental Syphilis in Rabbits. Ruth A. Boak; Charles M. Carpenter and Stafford L. Warren.

Am. J. Syph., Gonorr. & Ven. Dis. 26:282 (May) 1942.

Experimental studies on syphilis are necessarily of long duration because of the time required for the development of lesions and the long periods of observation of the treated animals and of those injected as a test for cure. The authors' experiments have been limited from time to time by intercurrent infection. As a consequence, it has not been possible to infect large groups of rabbits with any one generation of spirochetes.

There is some evidence that the strains of spirochetes employed in these studies have become more resistant to heat than they were in the earlier experiments carried out between 1930 and 1937. Because the minimal curative dose of fever required for the present generation of spirochetes was unknown, both the amount of fever and the amount of nearsphenamine were selected on an empirical basis.

On the basis of the data recorded in the present report, it is apparent that a mode of therapy combining a subcurative dose of nearsphenamine with a subcurative artificial fever gives superior results in the treatment of experimental syphilis

in rabbits than greater amounts of drug or fever alone.

Since the completion of this study, Eagle, of the Johns Hopkins Hospital, has pointed out that tests for cure of experimental syphilis in rabbits should not be made for at least six months after treatment. His opinion is based on work as yet unpublished. The animals in this study were held for from one to five months after treatment before tests for cure were carried out. Even though an increase in the time the rabbits were held might have slightly reduced the percentage of cures, a valid difference would still exist between the animals treated with nearsphenamine and fever and the control animals.

The time of administration of the drug in relation to the fever is significant. When the drug was given immediately before a fever treatment of three or four hours' duration, almost 100 per cent of the animals recovered; but when the drug was given at the termination of the fever, only 75 per cent were cured. The higher percentage of cures, obtained when the drug was given before the fever, may possibly be attributed either to a more widespread distribution of the drug as a result of an increased vascular response, or to an increase in the spirocheticidal action of the drug as a result of the elevation in body temperature. Eagle has shown that an increase in temperature enhances the spirocheticidal action of the arsphenamines *in vitro* and, furthermore, that arsenoxide, an oxidation product of arsphenamines, possesses a greater spirocheticidal activity than the compounds from which it is formed. It is possible that the superior results from the therapeutic procedure described in the present report have their origin in an increased production of arsenoxide brought about by the elevated body temperature.

Present observations on the treatment of experimental syphilis in rabbits are consistent with the observations reported for the treatment of syphilis in man with a combination of fever and arsenicals. Because of the variety of methods that were employed in these reported studies, however, no statement as to the relative efficacy of nearsphenamine administered before fever and following fever is possible.

Experimental syphilis in rabbits can be cured by a mode of therapy combining a subcurative dose of nearsphenamine (10 mg. per kg. of body weight) with subcurative artificial fever (three or four hours at 41.5 C.). Superior results are obtained when the drug is administered immediately before the fever is induced rather than immediately following the termination of the fever.

Obliterative Peripheral Vascular Diseases, Diagnosis and General Management. Wilfred D. Langley and A. Ashley Rousuck.

Guthrie Clin. Bull. 11:135 (April) 1942.

The most fundamental principle in the treatment of patients with obliterative vascular disease with ulceration or gangrene is complete bed rest. This will reduce to a minimum the circula-

tory requirement of the extremity, retard effect on infections and provide relief from pain.

All patients with obliterative vascular disease except those with acute infection should perform Buerger's exercises. The original suggestions of Buerger should be modified to fit the patient.

"No smoking, now and forever" must be the outlook of the patient.

Wright states "as a more cheerful and compensatory form of treatment, use of alcohol may be prescribed; it is our experience that patients rarely object to this form of therapy."

Care of the extremities with impaired circulation is most important. Care of nails, corns, callosities and the frequent use of lanolin to prevent drying and cracking of skin is a vital necessity. Feet should be washed daily and carefully dried. Where epidermophytosis has occurred, soaking in 1 to 10,000 potassium permanganate, thirty minutes every few days is recommended until the fungous infection has disappeared. The use of strong antiseptics is forbidden.

Boric acid solution or physiologic solution of sodium chloride at 36 to 38 C. (96-100 F.) have been recommended in place of wet dressings and are used two or three times daily over fifteen minute periods with great care being taken in regard to keeping the temperature within proper limits. The feet should be carefully dried after each soaking.

Reflex heat treatments are especially valuable in production of reflex vasodilatation. The application of warm pads, short wave currents, diathermy and hot soaks to various portions of the body not involved will produce the necessary vasodilatation. Local intensive heat applied to the area of an extremity to which the blood supply is impaired is most injurious.

The beneficial effect of nitrites, theobromine and allied compounds, papaverine and choline compound vasodilatory drugs is questionable and doubtful.

Mechanical devices are commonly used at present as a physical measure to increase the blood flow in cases of peripheral vascular disease. The Pavex intermittent pressure and suction apparatus or the so-called boot treatment was one of the first forms of mechanical therapy to be heralded as a "sure-cure" apparatus for occlusive vascular disease. Clinical results have not been nearly as striking as experimental studies had promised. According to reports of Horton, Wright and Sturr, actual experience with the apparatus has markedly reduced the indications for its use.

Intermittent venous hyperemia has been employed for a number of years in the treatment of occlusive vascular disease. The apparatus is a mechanical device which alternately regulates the inflation and deflation of a pneumatic cuff which is placed around the proximal portion of the extremity, usually the thigh. The amount of pressure should not exceed the diastolic pressure of that extremity and usually varies between 60 and 90 mm. of mercury.

The effect of this treatment is supposedly due to a mechanical filling and stretching of the

vascular tree during venous compression with chemical vasodilatation and reactive hyperemia thought to be histamine produced, occurring secondary to blood flow debt and oxygen debt. Because of the variance of reports this treatment is questionable but should be allowed fair trial. The ordinary blood pressure apparatus can be used where the automatic device is not obtainable.

The newest form of mechanical therapy in occlusive vascular disease is the Sanders vasocillator which has been receiving popular acclaim. Actually, this is a form of Buerger's exercise which can be carried out continuously for twenty-four hours a day if necessary, but according to Horton and associates "the Sanders bed is the simplest but undoubtedly the best mechanical device now in use for the treatment of subjects who have occlusive arterial disease of the extremities." Treatment may be carried over a period of months, with encouraging progress.

Physical Therapy Technicians. Alden B. Mills.

Mod. Hosp. 58:59 (Jan.) 1942.

The average salary of physical therapy technicians, including the fair cash value of maintenance, is \$124 per month, according to reports sent in for The Modern Hospital's salary survey. A total of 297 hospitals reported salary for such technicians from the 1244 hospitals sending in data for tabulation.

The overall average salary paid physical therapy technicians represents a more standardized salary condition than exists among most of the other employe groups covered by this nation-wide survey.

Traumatic Neuroses and Psychoses. Louis J. Karnosh.

West. J. Surg. 49:606 (Nov.) 1941.

The treatment of true traumatic brain disease, particularly if the mental and physical symptoms are pronounced, is a long and painstaking ordeal. However, it is worth the effort, for in time 75 per cent of these patients show a gradual but definite improvement.

Above everything else, the patient should be maintained in a quiet, restful place, free from worry or excitement. Few associations should be allowed to avoid the provoking of irritability, quarrelsomeness and emotional explosions.

Where there are focal types of defect such as aphasia or paralysis, of prime importance are re-education and training by experienced instructors under the direction of the physician.

Various forms of occupational therapy beginning with the simplest procedures have a decided palliative effect in reestablishing the powers of attention and mental effort, as well as reducing the irritability and agitation.

Nearly 50 per cent of all patients who have suffered a mild or even insignificant concussion come to the neuropsychiatrist with a syndrome which is tantalizing to the physician because of

neurologic signs there are none and of subjective symptoms there are many.

The working capacity of those patients is poor and an insistence on dispatching such patients back to work prematurely, invariably results in a fresh collapse.

Ideal treatment is rest and seclusion away from noise, excitement and out in the open air. Simple exercise such as walking is preferred and is to be encouraged. Straining at physical labor or violent movement of the body is not recommended.

In every case of head injury where litigation is pending and the physician may be called to testify, he should be fortified with certain facts.

The pretraumatic history should include the following:

- a. The general nature of the patient's normal personality.
- b. Records of previous nervous or mental illness.
- c. History of alcoholic habits.
- d. Domestic compatibility.
- e. Financial status.
- f. General reputation.

In the inspection and examination of the patient the following data are pertinent:

- a. The patient's attitude in reference to litigation.
- b. His ability to tell the truth.
- c. His tendency to exaggerate symptoms.
- e. His suggestibility.
- f. His efforts at malingering.

Three great trends in human behavior as a reaction to head injury have been presented. It is needless to add that this interpretation is a general one and that many individuals show a mixture of all three of these tendencies.

Of a further increase in the number of head injuries we are certain; for a clearer knowledge of what to do in each individual case, we can all continue to labor. The subject as a whole is not only a challenge to the neurologist, surgeon and psychiatrist, but the consequences of head trauma claim the attention of the industrial physician, insurance companies, state industrial commissions, legal authorities and in fact every person who has an interest in the preservation of human life and health.

Massage, Movements and Exercises in the Treatment of Nerve Suture and Repair. James Mennell.

Brit. J. Phys. Med. 5:40 (March) 1942.

Controversy has raged over the suitability of massage for flaccid paralysis since so much more harm than good may be done by abuse of treatment. Factors such as these must not be used to make a case for condemning the legitimate and proper use of massage, particularly as the latter can be very important. The masseur or masseuse whose main delight in treatment is to see "a good healthy red glow" in the skin over the paralyzed muscles is to

be avoided as unfit for this type of work. Only by the most careful and delicate touch can we hope to render useful service; to compress a flaccid muscle against a bone is an unpardonable sin, second only to that of splint or bandage pressure. The object of applying massage to flaccid muscles is to move the muscle fibers themselves and the fibrous tissue surrounding them, so as to maintain mobility. In ordinary life any form of massage which is calculated to have a baneful effect is counteracted by reflex contraction—a manifestation of the instinct of self-preservation. If, however, the muscles are unable to respond by contraction, reflex or otherwise, it follows that they are impotent to protect themselves and so are vulnerable to every injury. Part of the general value of massage is no doubt to stimulate the activity of the unstriated muscle fibres in the walls of the arterioles. The first effect of massage is to cause a reflex contraction; soon the reflex arc begins to tire and then a paralytic effect is liable to follow which may defeat the very objective which it was hoped to attain. So far as the rest of the limb is concerned, full brisk massage may, and should, be given with advantage, and one of the ways in which it is possible to judge between good and bad technic is to compare the changes in technic which take place when treating paralyzed muscles and when treating muscles which have remained normal.

Space prevents a full discussion of postural treatment; following are given the main laws:

1. Teach the antagonist to relax.
2. Demonstrate on the sound limb not only how relaxation of the antagonist is an essential part of the prime-mover, but also the movement for which the prime-mover is individually responsible.
3. The adjustment of the load through the use of gravity should be so gradual that the addition of the load should be imperceptible to the muscle although perceptible to the senses of masseur and patient alike.
4. At every joint there is some one movement over which one particular muscle presides; it is this one movement which must be sought out for practice in the initial stages.
5. The blending of rest and activity is an art in itself.
6. Both masseur and patient can go "stale." When this happens a change of hands, or better still a complete holiday from treatment, is often of the utmost help.
7. A muscle will first begin to contract when the limb is placed at a position of perfect comfort as near to the limit of the inner arc of the range of movement as can be secured.
8. Fatigue is probably the worst enemy of any paralyzed muscle and to try to encourage a muscle to contract a second time because it has already done so once is often a satisfactory way of postponing recovery.
9. It is absolutely necessary to keep in the fullest possible activity all muscles which are not affected and if possible in unison with the muscles of the unaffected side.

Laryngeal Tuberculosis. Bertram T. Mann.

Practitioner 148:231 (April) 1942.

Ordinary sanatorium therapy, with rest and regular meals, which gives rise to an improvement in both the lung and general condition, helps to improve the local laryngeal resistance to disease. This regimen in itself, however, should necessarily be supplementary to other treatment.

Dworetzky and others (1930) have shown conclusively that collapse therapy is not only markedly beneficial to the lung condition but also to the laryngeal disease.

The sheet anchor of treatment of laryngeal tuberculosis still remains vocal rest. Absolute vocal rest for a period of four to six months is far from a simple matter to impose on any but the most intelligent and cooperative type of patient; yet when pursued with perservance by the physician and the patient it yields satisfactory results. Whispering is an alternative to the absolute vocal rest, but the danger lies in the patient adopting a forced stage whisper, which places more stress on the vocal cords than does normal speech.

Ultraviolet therapy has been suggested and has been attempted fairly widely by many laryngologists and a wide range of applicators have been employed. In the hands of skilled workers some of these methods have met with a measure of success, but Sir St. Clair Thomson (1932), after repeated and thorough trials, is of the opinion that this mode of treatment can hardly be deemed satisfactory. Indeed, when the difficulty in the introduction of special applicators is considered and also the discomfort of the patient and the difficulty in focusing the beam on the affected area, such a conclusion is not surprising.

The basis of cautery treatment for laryngeal tuberculosis rests largely on the principle of producing a zone of reaction around the affected part and thereby stimulating the natural tendency of the body tissues to proliferation of fibrous tissue and healing. Most satisfactory results have been recorded, both by Continental and British workers, on selected cases in this field of therapy.

Influence of Temperature on Wounds. B. Brooks and G. Duncan.

Ann. Surg. 114:1069 (Dec.) 1941.

Brooks and Duncan determined the effect that temperature had on the healing of experimental wounds in dogs. Three pairs of symmetrical points on the backs of the dogs were chosen. Two of the points were subjected to the application of heat and two to the application of cold, and two were not influenced by either application. The experiments suggest that it is doubtful whether it is wise to inhibit inflammatory reaction by the application of cold or of heat to the extremities of a patient in surgical shock. The

conditions are natural responses, and efforts to reverse normal physiologic processes bring to mind the discarded fever-reducing drugs of the past. — (Abst. J. A. M. A. 118:844 [March 7] 1942.)

Vesicular and Vesiculopustular Eruptions of the Hands and Feet—Diagnosis and Treatment. S. William Becker.

J. Michigan M. Soc. 41:111 (Feb.) 1942.

The common reaction on the part of the physician when a patient presents vesicular, vesiculopustular, macerated or fissured lesions on the feet and/or hands is to diagnose fungous infection and to apply a strong ointment, such as Whitfield's ointment, which contains salicylic and benzoic acids. Whitfield's admonition that the ointment must be used with care on account of its high salicylic acid content has been ignored, with the result that dermatitis venenata is all too frequently produced. It should be remembered that vesicular fungous infection constitutes eczema produced by fungous allergens in an individual with a hypersensitive epidermis. The condition should, therefore, be treated first of all as eczema and only after the acute stage has subsided can fungicidal medicaments be used with impunity.

If functional dermatosis is the diagnosis, the patient should be placed on a general regimen for functional disease, consisting of restriction of activities, a daily nap, daily exposure to sunshine, natural or artificial and a general slowing up. Social problems should be solved if possible. Local treatment consists of wet dressings to be followed by the application of White's five per cent crude coal tar ointment which is efficacious in restoring the normal keratinization cycle. Roentgen therapy, cautiously used, is advantageous in all varieties of dermatitis of the hands and feet.

Vesicular eruptions of the hands and feet may be produced by irritants or allergens reaching the skin from the outside or by fungous allergens originating in the stratum corneum of the feet.

Allergic vesicular reactions (dermatomyxids) of the palms may result from absorption of fungous allergens from the feet and transportation through the blood stream.

Many vesicular and vesiculopustular eruptions of the hands and/or feet can be attributed to no organic cause, and evidently belong in the large group of functional diseases. Local applications should always be mild at the start of treatment, to be replaced by stronger applications as the acute reactions subside.

Local applications for functional dermatoses should be fortified by general measures designed for the relief of functional disease.

